PHILIPS

One Line-Two Line XYt Recorders
PM8271-PM8272

Service Manual

TEST & MEASUREMENT CUSTOMER SUPPORT

METRUM
INSTRUMENTATION SERVICE
370 N. Bernardo Avenue
Mountain View, CA 94043-5299

4822 872 75309
880510

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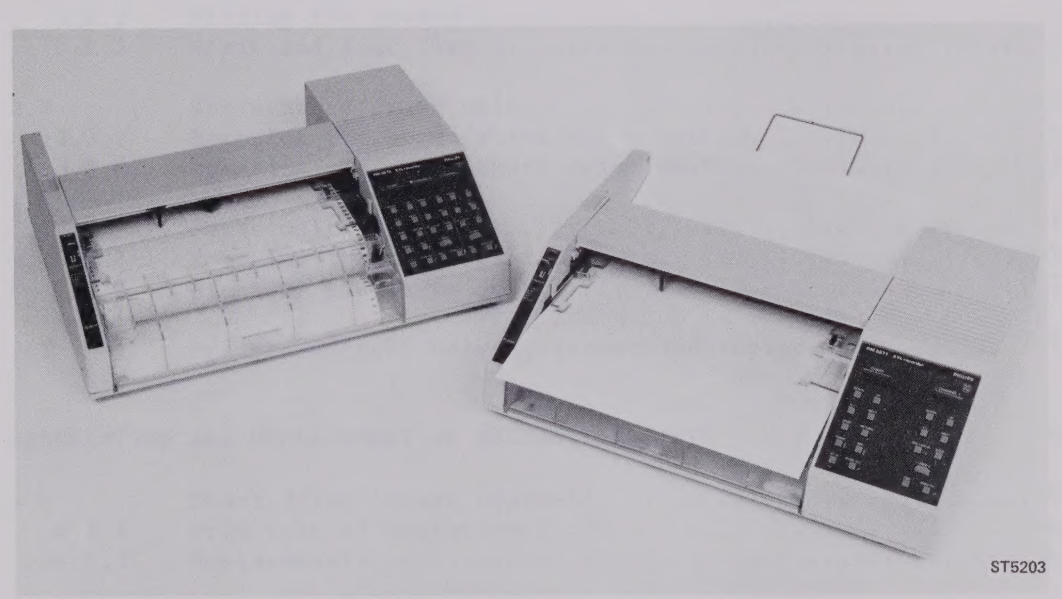

ST5203

WARNING: These servicing instructions are for use by qualified personnel only. To reduce the risk of electric shock do not perform any servicing other than that specified in the Operating instructions unless you are fully qualified to do so.

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1. SAFETY INSTRUCTIONS

Read these pages carefully before installation and use of the instrument.

The following clauses contain information, cautions and warnings which must be followed to ensure safe operation and to retain the instrument in a safe condition.
Adjustment, maintenance and repair of the instrument shall be carried out only by qualified personnel.

GENERAL CLAUSES:

WARNING: The opening of covers or removal of parts, except those to which access can be gained by hand, is likely to expose live parts, and accessible terminals which can be dangerous to life.

- The instrument shall be disconnected from all voltage sources before it is opened.

- Bear in mind that capacitors inside the instrument can hold their change even if the instrument has been separated from all voltage sources.

WARNING: Any interruption of the protective earth conductor inside or outside the instrument, or disconnection of the protective earth terminal, is likely to make the instrument dangerous. Intentional interruption is prohibited.

- Components that are important for the safety of the instrument may only be renewed by components obtained through your local Philips organisation.

- After repair and maintenance in the primary circuit, safety inspection and tests, as mentioned in Section 8 have to be performed.

2. CHARACTERISTICS

For the characteristics of the instruments (technical specification, environmental conditions etc.) refer to the Operating Manual, ordering number 4822 872 70339.

3. DISMANTLING THE INSTRUMENT

3.1 GENERAL INFORMATION

This section provides the dismantling procedures required for the removal of components during repair operations. All circuit boards removed from the instrument must be adequately protected against damage, and all normal precautions regarding the use of tools must be observed. During dismantling a careful note must be made of all disconnected leads so that they can be reconnected to their correct terminals during assembly

CAUTION: Damage may result if:

- The instrument is switched on when a circuit board has been removed.
- A circuit board is removed within one minute after switching-off the instrument.

3.2 COVERS, FRONT AND REAR FLAP (figure 3.1)

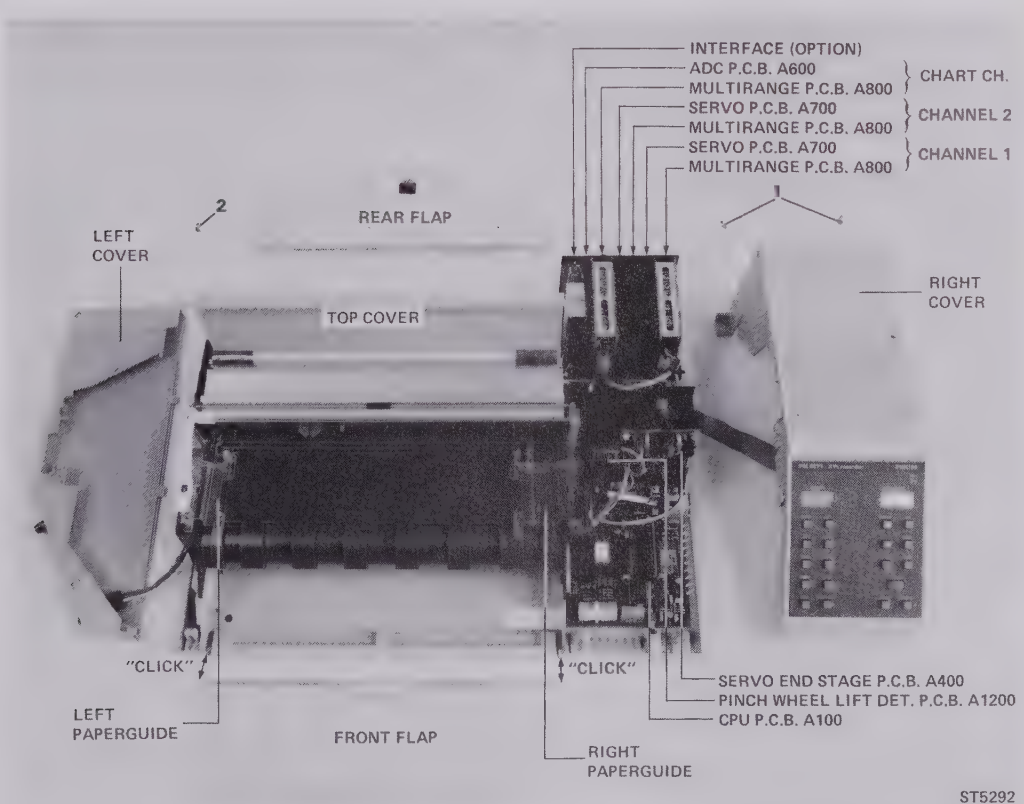


Figure 3.1 PM8271 parts location

3.2.1 Removing the covers (figure 3.1)

Right hand cover

- Unscrew the screws item 1
- Hinge the top cover upwards
- Lift the rear side of the cover about 8 cm and take it off
- Take the flat cable out off its guide and place the cover next to the recorder.

Left hand cover

- Unscrew the screw item 2
- Hinge the top cover upwards
- Lift the rear side of the cover about 8 cm and take it off
- Lay down the cover as indicated

NOTE: The plastic coupling piece and the metal rod for the pinch wheel lift mechanism may possibly drop off. They can easily be mounted again, refer to section 4.1.2.

3.2.2 Fitting the covers (figure 3.2)

Right hand cover

- Close the rear flap and open the front flap and top cover
- Position the round pin of the cover (item 1) in front of the pin on the base (item 2), holding the cover as indicated
- Watch out for the flat cable to the display P.C.B., as it may become trapped and broken
- Lower the rear side of the cover, the edge of the text plates must match the groove in the cover
- Fasten the screws

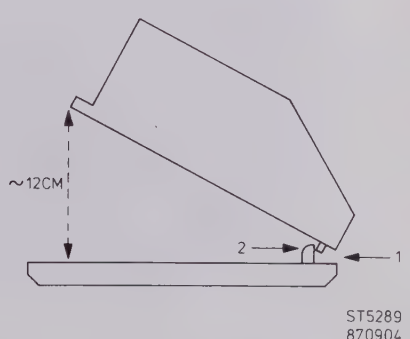


Figure 3.2 Mounting the covers

Left hand cover

- Mount the operating rod and coupling piece for the pinch wheel lift mechanism (see section 4.1.2)
- Open the front and rear flap and the top cover

- Position the round pin of the cover (item 1) in front of the pin on the base (item 2), holding the cover as indicated in figure 3.2.

- Lower the rear of the cover, watch the mains switch cable loom and shift the LOAD/OPERATE slider up and down so that it matches the rectangular hole in the coupling piece

- Fasten the screw

3.2.3 Front and rear flap (figure 3.1)

The flaps are "clicked" in the slots of the frame. The front and rear flap are not identical. The rear flap is equipped with a black piece of foam and a reflector strip. The position of the flap is detected by an optical sensor, H1301, on the rear flap detection P.C.B., A1300 (closed for sheets, slightly opened for fan fold books).

3.3 SERVO/CHART DRIVE UNIT (figure 3.3)

The servo/chart drive unit consist of the complete mechanics for the servo system and the chart drive system. The unit can function, when it is separated from the base.

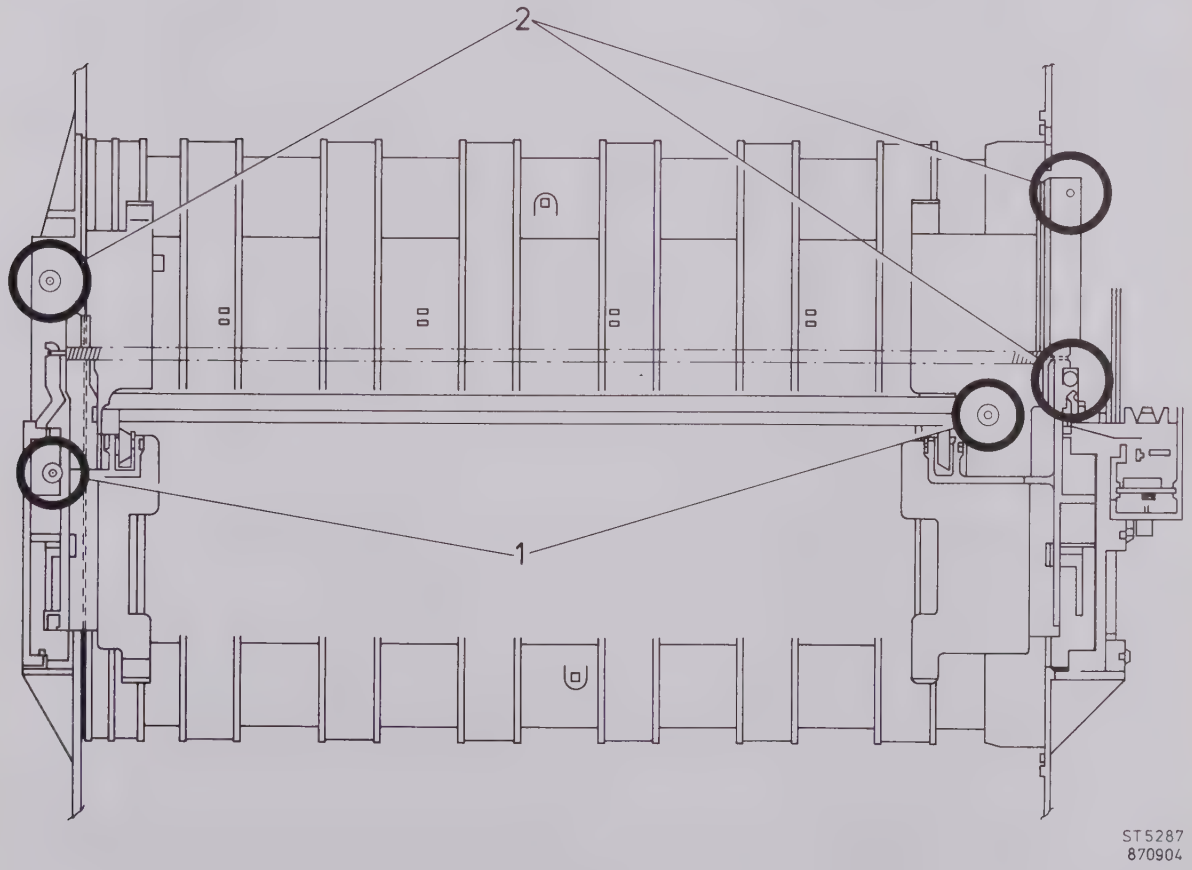


Figure 3.3 Servo/chart drive unit

3.3.1 Removing the servo/chart drive unit

- Remove the left and right hand cover (section 3.2).

- Remove the white plastic coupling piece and the metal rod (figure 3.1).

- Unscrew the 2 crosshead screws item 1 in figure 3.3. The screws can accessed via a hole in the paper guide.

- Take off the unit and put it down as indicated in figure 3.6.

3.3.2 Mounting the servo/chart drive unit

The servo/chart drive unit is positioned on the base by means of location dogs and 4 guides, see figure 3.4.

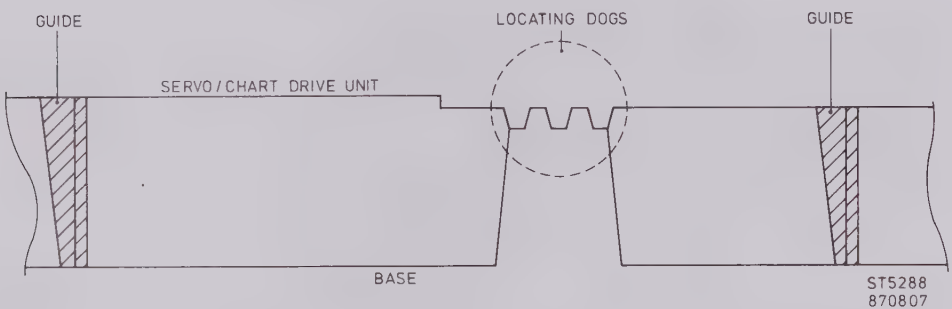


Figure 3.4 Positioning the servo/chart drive unit on the frame

- Put the unit on the base

- Fix the two screws item 1 in figure 3.4.

3.4 SERVO UNIT

The servo unit consists of the:

. Measuring potentiometer(s)
. Servomotor(s)
. Carriage(s) and pen holder(s)
. Pen lift mechanism
. Servo end stage printed circuit board A400

3.4.1 Removing the servo unit

- Remove the left- and right hand cover (see section 3.1)

- Unscrew the three screws item 2 in figure 3.3.

- Disconnect the red earthing wires (one at each side) BY UNSOLDERING; if the solder tag screws are loosened, the servo unit extrusions must be adjusted (see section 4.2.3)

- Disconnect
  * The red/blue motor cable marked "3"
  * The main cable loom (3 connectors) from P.C.B. A400
  * The flat cable to the CPU P.C.B.

- Take off the servo unit.

3.4.2 Mounting the servo unit

- Place the servo unit on the recorder and connect the cables and earthing wires

- Fix the left screw, item 2 in figure 3.3.

- Tighten the right screws just tight enough so that the right side of the servo unit can be moved

- Load a sheet of paper and draw a coordinate system (AXES); both axesmust be drawn perpendicular to each other. If not, shift the right end of the servo unit.

3.5 PRINTED CIRCUIT BOARDS, ACCESS AND REPLACEMENT (Figures 3.6 and 3.7)

Access

P.C.B.	remove part	section
A100, CPU	right hand cover servo/chart drive unit	3.2.1 3.3
A200, DISPL/KEYBOARD	right hand cover	3.2.1
A400, SERVO END STAGE	right hand cover	3.2.1
A500, ENCODER	servo/chart drive unit	3.3
A600, ADC	right hand cover	3.2.1
A700, SERVO	right hand cover	3.2.1
A800, MULTIRANGE	right hand cover	3.2.1
A1000, POWER SUPPLY	servo/chart drive	3.3
A1100, PAPER DETECTION	servo/chart drive	3.3
A1200, PINCH WHEEL LIFT DETECTION	right hand cover	3.2.1
A1300, REAR FLAP DETECTION	servo/chart drive	3.3

Replacement

A100 - Unscrew the crosshead screws in the bottom

NOTE: the P.C.B. is delivered without the EPROM

A200 - Unscrew the crosshead screws in the cover

A400 - Loosen the connectors, write down the numbers and corresponding connector place
- Unscrew 2 crosshead screws

A500 - Insert a screw driver between the edge of the board and the encoder housing to push the retaining tabs aside

A600 - Remove the text plate at the rear and pull the CHART channel input unit (A600 + A800) upwards
- Unscrew the 2 crosshead screws (in metal screening)
- Unsolder the flexible interconnection strip from A600

A700 - Remove the text plate at the rear and pull the input unit of CHANNEL 1 or 2 (A700 + A800) upwards
- Unscrew the 2 crosshead screws (in metal screening)
- Unsolder the flexible interconnection strip from A700

A800 - Remove the text plate at the rear and pull the relevant input unit upwards
- Unscrew the 2 crosshead screws (in metal screening)
- Unsolder the flexible interconnection strip from A600 (CHART channel) or A700 (CH.1 or 2)

The MULTIRANGE P.C.B. A800 used for CHANNEL 1 and 2 is slightly different from the one used in the CHART channel. The basic P.C.B. for both applications is the same, but some resistors must added, depending upon the application. These resistors are delivered with the basic P.C.B.

- If used in the CHART channel, mount resistors

*R837 (ZERO potentiometer), 22K, 20%
*R834, 12K7, 0.1%
*R864, 20K, 0.1%

- If used in CHANNEL 1 or 2, mount resistor

*R834, 5K11, 0.1%

A1000 - Remove the plate marked "DANGER etc."
- The board can be taken out after removing one crosshead screw

A1100 - Remove the drive shaft (see section 4.1.2)
- Unscrew the crosshead screw

A1200 - Press the retaining notch "A" into the indicated direction and pull upwards the board

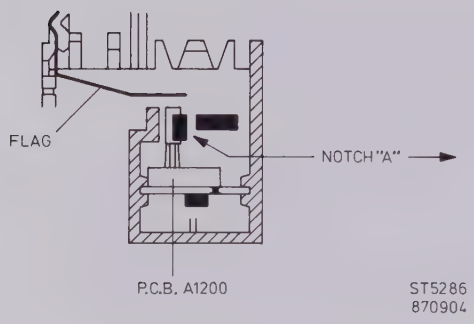


Figure 3.5 A1200, top view

A1300 - Unscrew the crosshead screw

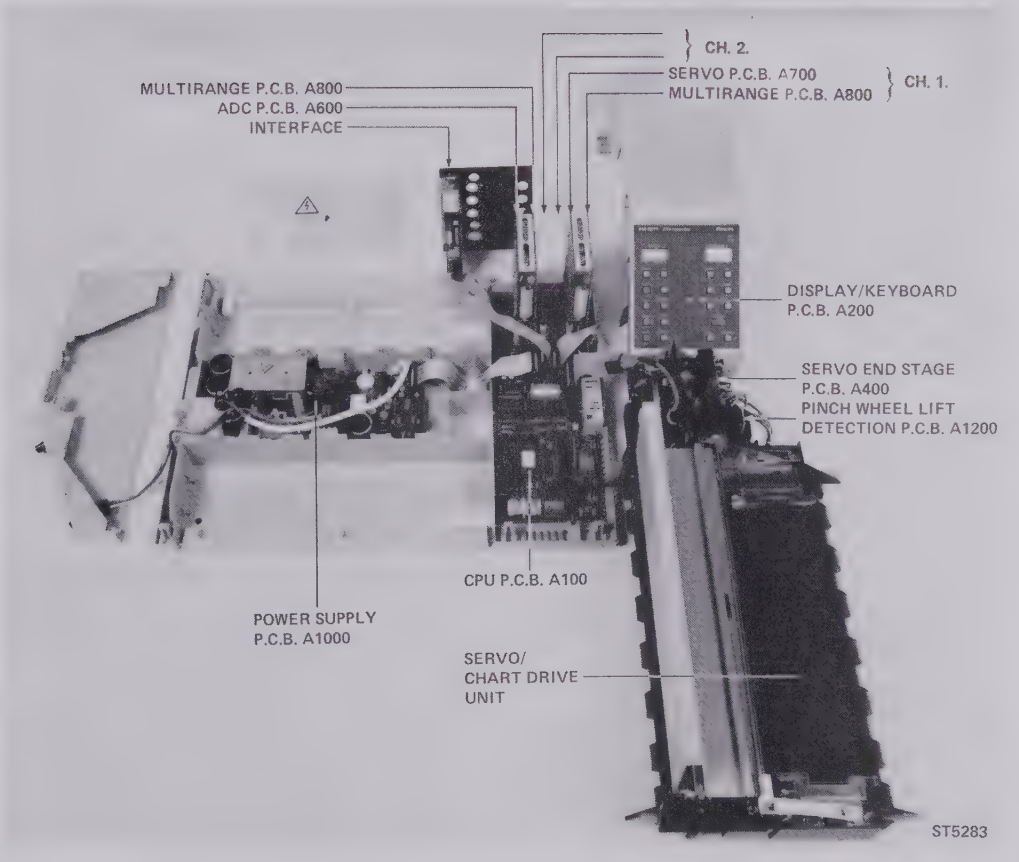


Figure 3.6 Location of P.C.B.

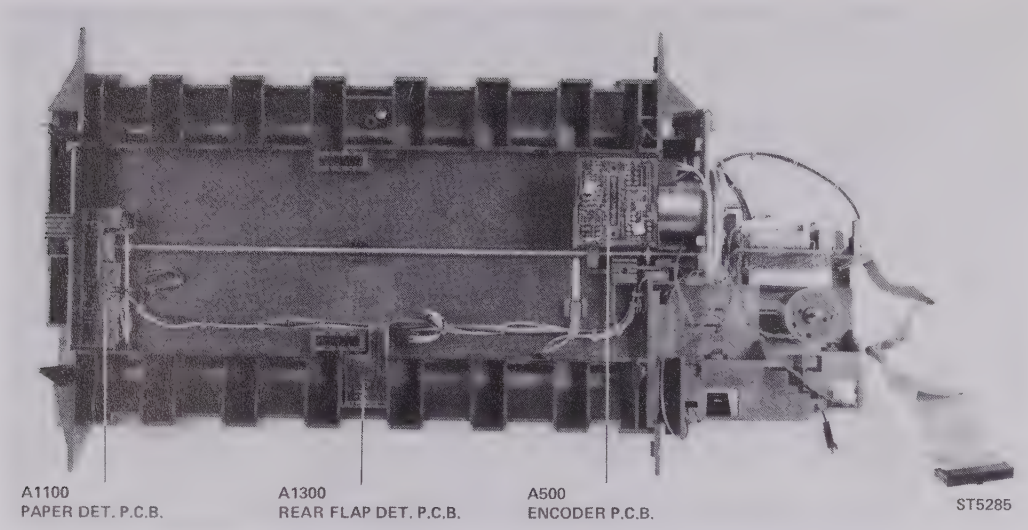


Figure 3.7 Chart drive unit, bottom view

4. DESCRIPTION AND REPLACEMENT OF MECHANICAL PARTS

4.1 CHART DRIVE (CHART CHANNEL)

4.1.1 Principle of operation

The chart is transported by means of a paper grip roller system, see figure 4.1.

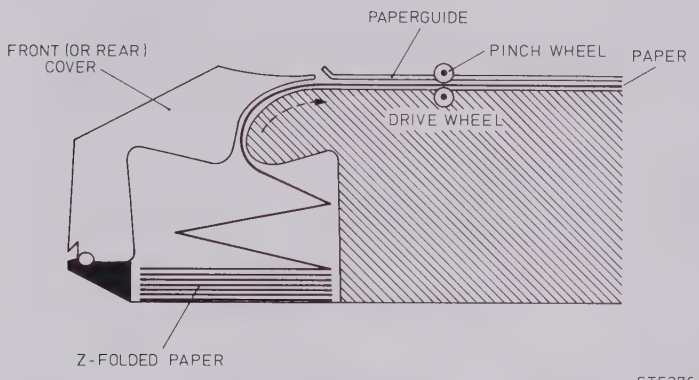


Figure 4.1 Chart drive mechanism

Two drive wheels are mounted on a shaft. The shaft is driven by a dc motor via a toothed belt. To control the chart speed, the number of revolutions of the motor is counted by an optical encoder disc. The information from the encoder is used as feed back in a digital servo system. For details see the circuit description.

The paper is pinched between the knurled metal drive wheels and the plastic pinch wheels.
The pinch wheels are mounted on the right- and left hand paper guide. To load the paper, the pinch wheels can be lifted.

Pinch wheel lift, pinch wheels, paper guides.

Figures 4.2 and 4.3 show the principle of operation of the pinch wheel lift mechanism.

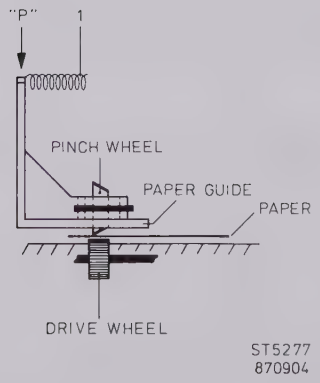


Figure 4.2 Pinch wheels down (OPERATE)

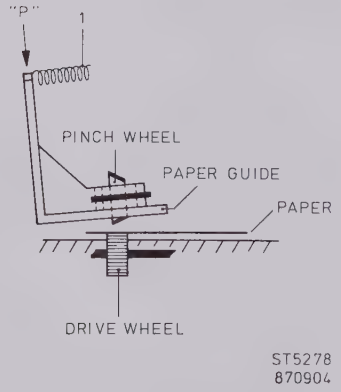


Figure 4.3 Pinch wheels up (LOAD)

Figure 4.5 shows how the paper guides are canted by means of the LOAD/OPERATE slider.

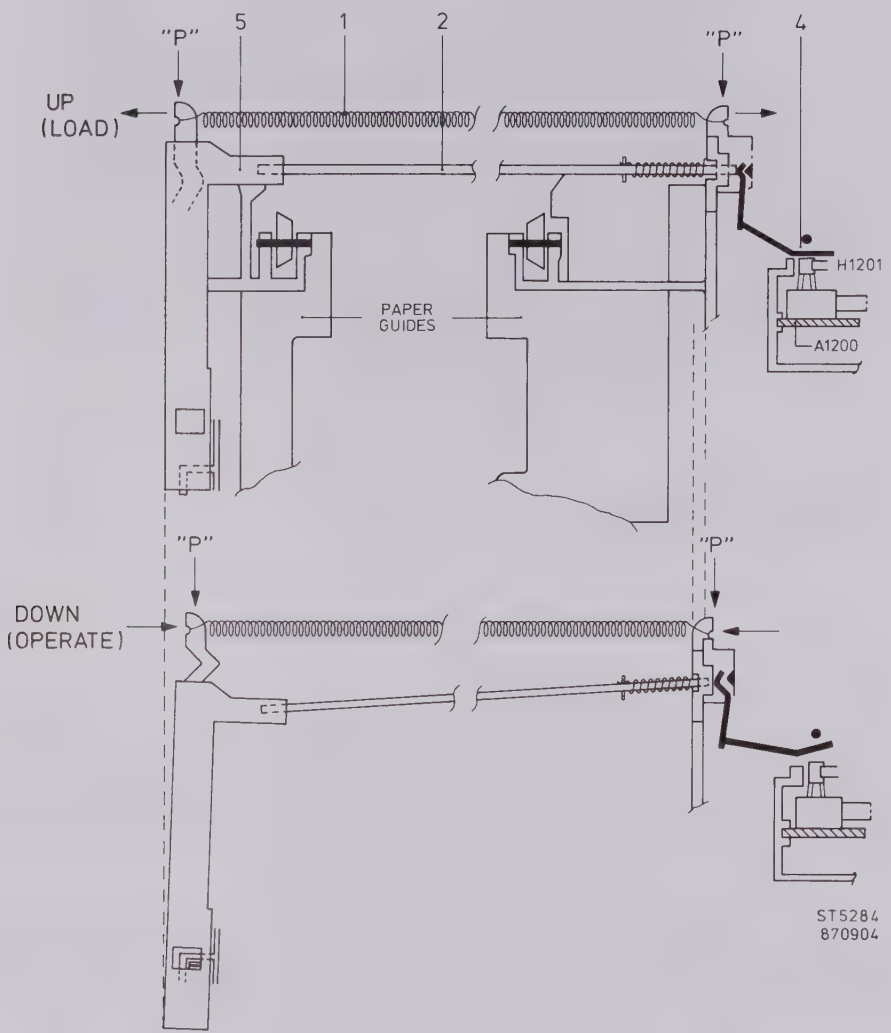


Figure 4.4 LOAD/OPERATE mechanism

Pinch wheels up (LOAD)

By pushing the LOAD/OPERATE slider into the LOAD position, the top of the paper guides are displaced outwards via the rod (item 2) and coupling piece (item 5). As a result the paper guides are canted.

Pinch wheels down (OPERATE)

When the LOAD/OPERATE slider is in the OPERATE positon, the spiral spring (item 1) can pull point "P" to each other. As a result the pinch wheels are pressed on the paper.

Pinch wheel up/down detection (LOAD/OPERATE detection)

The rod item 2 operates the flag item 4. The position of the flag is detected by opto device H1201 on printed circuit board A1200. H1201 contains a light emitting and a light dependent semiconductor. For further details see the circuit description of P.C.B. A1200.

Paper detection

To detect:

- If the chart is correctly positioned against the left side (POSPP)
- The start position of the chart (recording area XY-tY mode)
- The end of the chart (recording area XY-tY mode, end of paper ErrPP in tX mode)

Two opto devices (each emitter-sensor) are mounted in the chart drive/servo unit on the paper detection P.C.B. A1200.
The emitted light is reflected by the chart and sensed by the sensor; if it is not, the reason will be one of the three possibilities listed above.
The black plate in the left paper guide absorbs the light if it is not reflected by the chart.

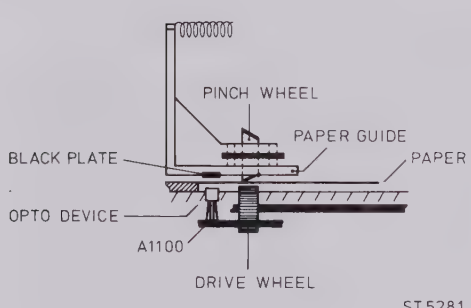


Figure 4.5 Paper detection (front view)

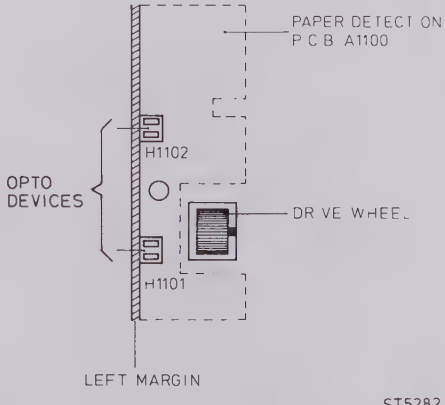


Figure 4.6 Paper detection (top view)

IT IS ADVISED TO CLEAN THE OPTO DEVICES REGULARLY; FILTHINES (DUST ETC.) WILL RESULT IN MALFUNCTIONING.
Clean by blowing, or by a brush if the paper guides are removed (see Replacements, section 4.1.2).

4.1.2 Replacements

For access, the right and left cover must be removed, see section 3.2.

Operating rod (item 2), coupling piece (item 5)

- After removing the covers, the operating rod and coupling piece can be taken off.
  For mounting see figure 4.4. The LOAD/OPERATE slider must match the rectangular hole in the coupling piece when mounting the left cover.

Paper guides (figures 4.7 and 4.8)

- Remove the operating rod, coupling piece and spiral spring.
- Loosen the servo unit screws (see section 3.4).
- Unlock the notches "A" by pressing down the outside and lifting the inside of the paper guides and shifting them inwards.
- Lift up the servo unit and remove the paper guide at the front.

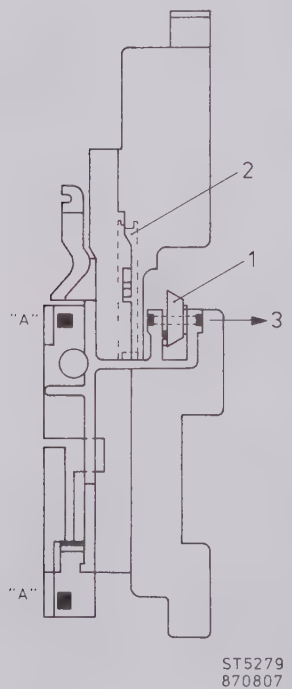


Figure 4.7 Left paper guide (top)

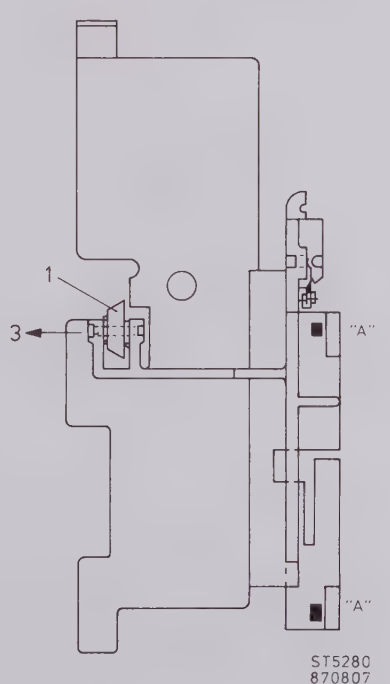


Figure 4.8 Right paper guide (top)

When mounting the paper guides, watch the pinch wheel lift flag (see figure 4.4 item 4).

Ordering numbers:

- Left hand paper guide	5322 466 30265	(without pinch wheel and black plate)
- Right hand paper guide	5322 466 30266	(without pinch wheel and LOAD/OPERATE detection flag)

Pinch wheels

a- Right side:
Remove the locking varnish. Remove the eccentric pin into the indicated direction (item 3 in figure 4.7 and figure 4.8).
To mount the pinch wheel, the exenter can easily be inserted.

b- Left side:
Remove the locking varnish. Remove the eccentric pin into the indicated direction (item 3 in figure 4.7 and figrre 4.8).
To mount the pinch wheel, the eccentric pin can easily be inserted.

Adjusting the chart transport.

The reproducibility of the chart transport can be adjusted by the eccentric pins in the pinch wheels of the paper guides.

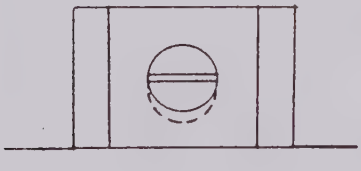


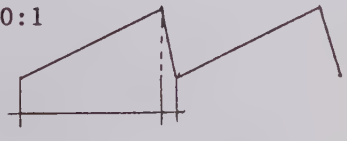
Figure a

Adjusting procedure:

1- Turn the eccentric pins in the lower position, see fig. a, left guide part seen from the right side.

2- MODE XT During fast forward and reverse transport of a book you should adjust the eccentric pins in such a way, that the left pinch wheel stays at the most right position and the right pinch wheel in the most left position.

3- MODE XY
Input signal paper channel: 0,5 Hz triangle 10:1



10 : 1

Amplitude: Adjust so, that you use 38 cm of paper. The overload position should be reached in both directions.

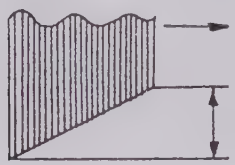
Input signal pen channel: 0,2 mHz triangle 10:1

4- Make the following registrations

NOTE: Use a new fan fold chart book.

10 registrations for "+" LENGTH
10 registrations "-" LENGTH
These registrations should be made at: the beginning of the book
the middle of the book
the end of the book
the middle of the book
the beginning of the book

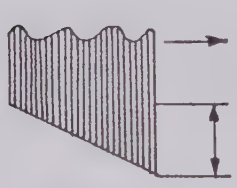
5- Deviations and adjustments



pen moves to the right

deviation

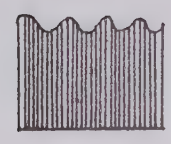
adjustment



pen moves to the right

deviation

adjustment



correct, no deviation

When the registation is correct, you should check it on a new piece of paper. Do not overcompensate!!
If another correction is necessary then repeat the registrations.

6- Secure the eccentric pin with locking varnish.

7- Open hingeable topcouver;
Put a correx meter between the spring at the rubber tulle;
Load the spring 1000 Nm to the left;
Now it should be possible to transport a book for 3 m in both directions without running away from the left side.

8- Check repeatability with an A3 sheet.

Ordering numbers:

- Pinch wheel	5322 528 81167
- Pin for pinch wheel	5322 520 40228
- Eccentric pin for the pinch wheel	5322 321 28760

There are different versions of chart transport:

1- No eccentric pin is used. This is the first version.
2- One eccentric pin is used. The older ones have an eccentric pin with a big diameter. If the eccentric pin must be replaced, the complete paper guide has to be replaced.
3- One eccentric pin is used with the same diameter as the normal pin.
4- The latest version is with two eccentric pins.

It is possible to modify earlier versions to the latest version, the exception is the one with the big diameter.

Black plate for paper detection sensors (figure 4.9)

Lift point "A" slightly and slide the plate into the direction indicated.

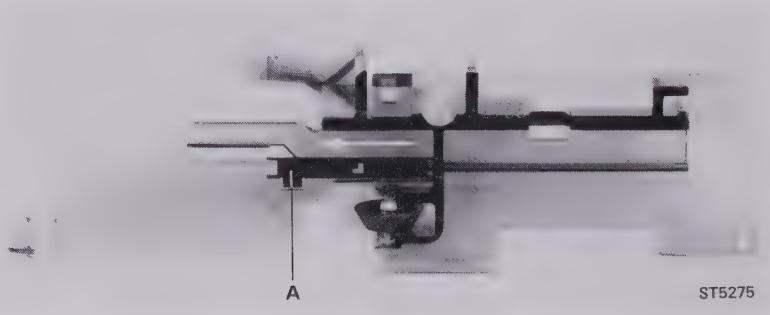


Figure 4.9 Black plate (bottom view)

Ordering number:

- Black plate 5322 466 30268

LOAD/OPERATE detection flag (figure 4.4 item 4)

Lift the retaining tab over the plastic stop. Ensuring the flag remains flat. Slide out away from the main body of the assembly

NOTE: If the flag does not move, check that the small tab on the end of the part is not catching in its hole.

Ordering number:

- LOAD/OPERATE flag 5322 466 30267

Chart motor + encoder (figure 4.10)

- Remove the servo/chart drive unit (see section 3.3)

- Unscrew the motor mounting plate to loosen it; remove the toothed belt.

- Unscrew the 3 motor fixing screws, pull out the connector and take out the chart motor/encoder unit.

The encoder P.C.B. A500 can be removed by unlocking the retaining tabs (insert a screw driver between the edge of the board and the plastic encoder housing. The P.C.B. can be "clicked" into the housing.

The encoder unit and motor may not be separated.

Ordering number

- Motor/encoder unit 5322 361 10456 (without P.C.B. A500)
- Encoder P.C.B. A500 5322 216 93833

Shaft + drive wheels (figure 4.10)

- Remove the servo/chart drive unit (see section 3.3)
- Remove the chart motor + encoder unit
- Remove the retaining bars (2x)
- Take out the shaft

Ordering numbers:

- Shaft	5322 535 92333	(complete with drive wheels, bearings, toothed wheel)
- Retaining bar	5322 492 63713	
- Sprung contact	5322 492 63713	
- Retaining bar (long)	5322 492 63925	

Toothed belt (60 t)

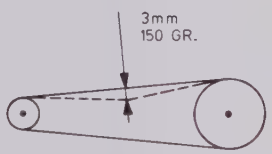
- Remove the servo/chart drive unit (see section 3.3)
- Loosen the motor mounting plate (figure 4.10) and take off the belt.

When mounting the belt, the tension can be adjusted by sliding the motor mounting plate. The shaft must rotate smoothly.

Applying a force of 150 gr. in the middle of the belt should give deviation of 3 mm.

Ordering number:

- Toothed belt 60-t 5322 358 30764



ST5319
870911

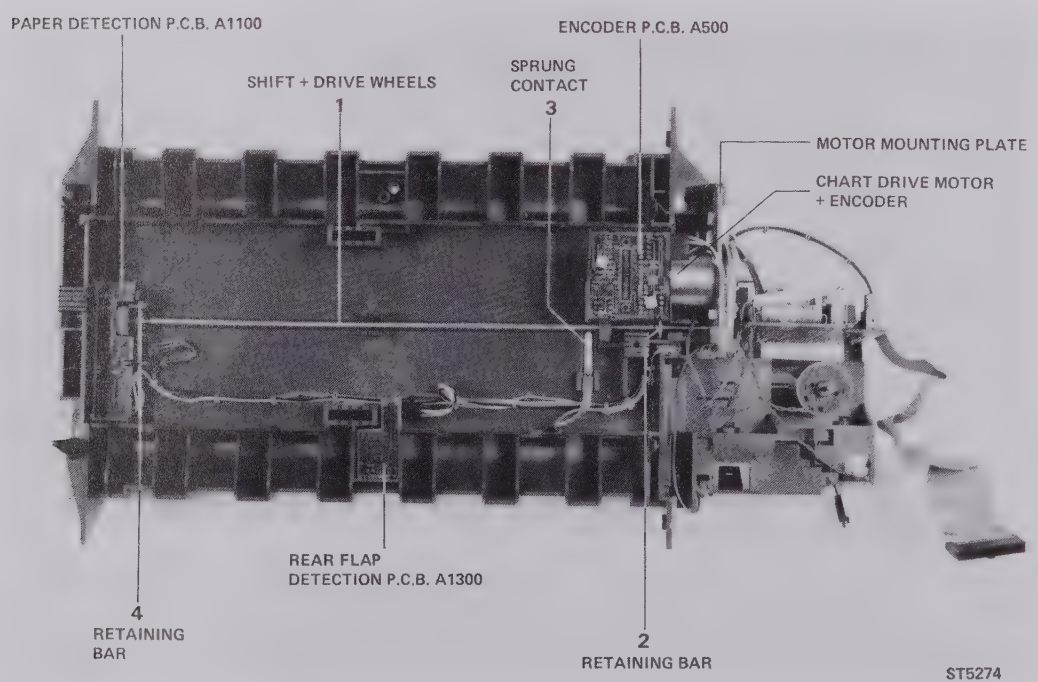


Figure 4.10 Chart drive parts location

4.2 SERVO SYSTEM CHANNEL 1 (AND CHANNEL 2)

4.2.1 Principle of operation

Each servo system consists of:

- Electronics (see circuit descriptions)
- Measuring potentiometer
- DC servomotor
- Measuring carriage/pen holder
- Pen lift mechanism

The servo system acts according to the principle of automatic compensation (like all PHILIPS line recorders):

a dc motor moves the carriage via a toothed belt. The position of the pen is fed back by sliding contacts in the carriage making contact with a straight wire wound potentiometer.

The pen is raised and lowered by means of a dc motor, as can be seen in figures 4.11 and 4.12

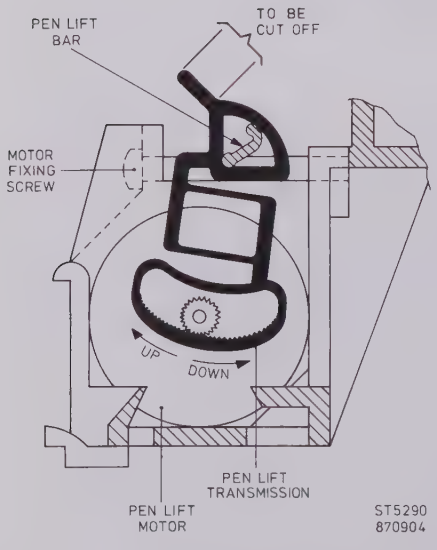


Figure 4.11 Pen lift

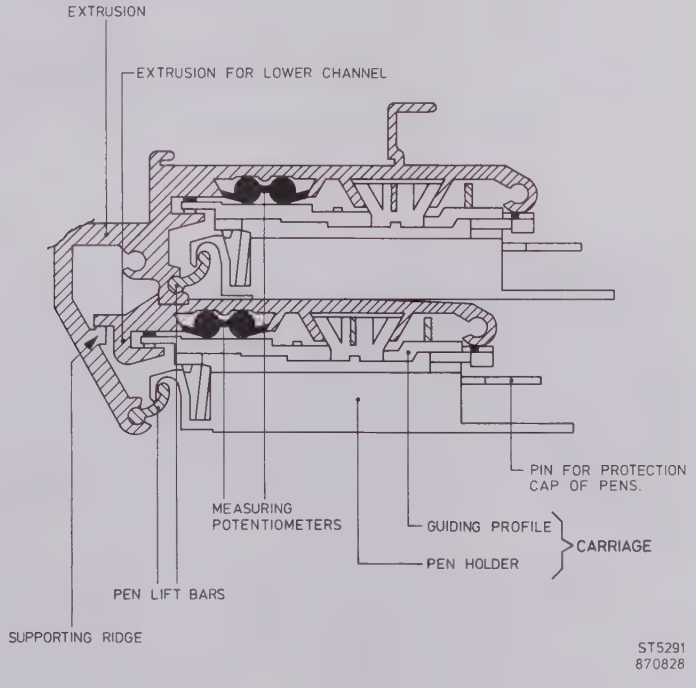


Figure 4.12 Carriage/pen holders, measuring potentiometers

4.2.2 Potentiometers and carriages

Removing the potentiometers and carriages.

- Take off the servo unit, refer to section 3.4.
- Remove the left pulley support (figure 4.14, item 2) by unscrewing the 3 crosshead screws (figure 4.13, items 1).
- Disconnect the measuring potentiometer's cables and loosen them.

UPPER POTENTIOMETER:

- Slide out the potentiometer to the left, approx. 5 cm (pull on the left end)
- Slide out the carriage (including the belt) to the left

LOWER POTENTIOMETER:

- Remove screw item 1 in figure 4.13
- The extrusion for the second line, including the measuring potentiometer and carriage, can now be taken out
- Slide out the potentiometer and carriage 5 cm approx.
- Slide out the carriage

Mounting the potentiometers and carriages.

Mounting is done in reversed order:

- Shift the potentiometers into the extrusions till 5 cm approx. is left
- Put the carriage onto the potentiometer; the contacts will touch the potentiometer rod: shift the carriage into the extrusion
- Shift the potentiometer up to the marking notch into the extrusion
- Mount the extrusion for the second line (including the potentiometer and carriage), fix screw item 1 (figure 4.14) not tight
  TAKE CARE THAT THE POTENTIOMETER CABLE IS NOT TRAPPED.

  NOTE: notice the supporting ridge and pen lift bar (figure 4.13)

- Lay the belt(s) on the pulleys of the pulley support and fix the pulley support (not tight)
- Lay the belt(s) on the motor pulley
- Adjust the servo unit extrusions, see section 4.2.3.
- Mount the servo unit on the recorder base (see section 3.4 for adjustment)
- Check the belt tension and adjust it if required (see further on)

Ordering numbers:

- Carriage 5322 256 91196 (equal for both channels)
- Potentiometer 5322 691 20417 (equal for both channels)

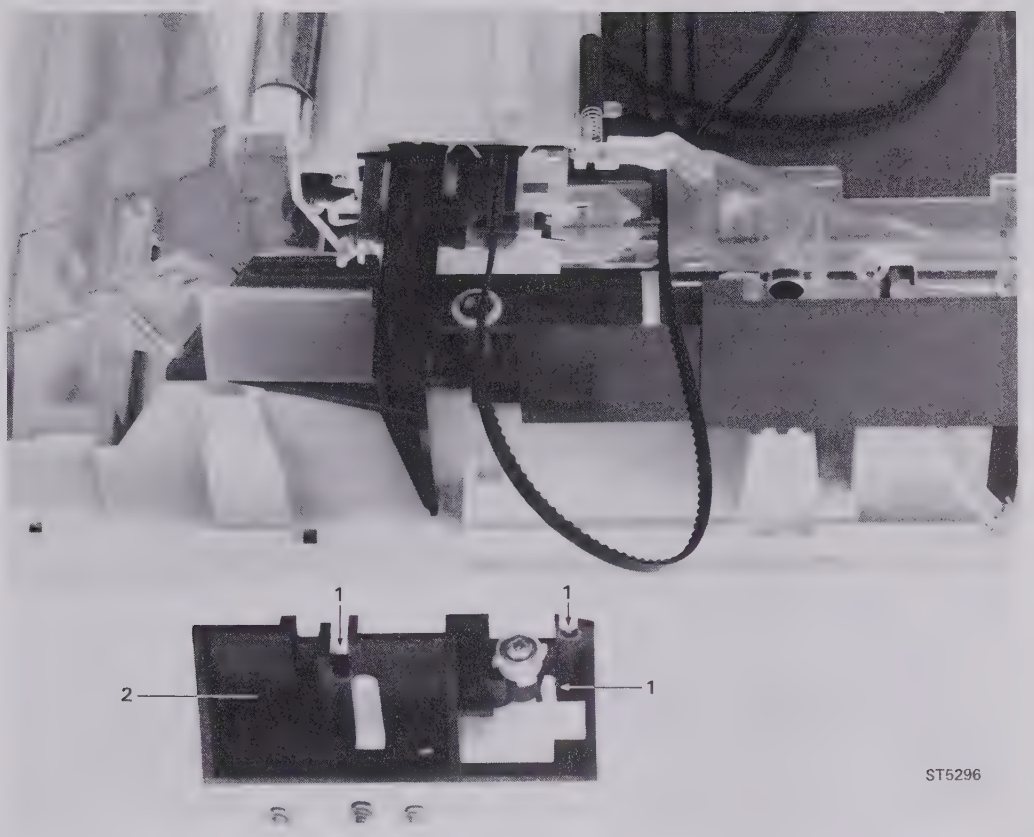


Figure 4.13 Removing the left pulley support

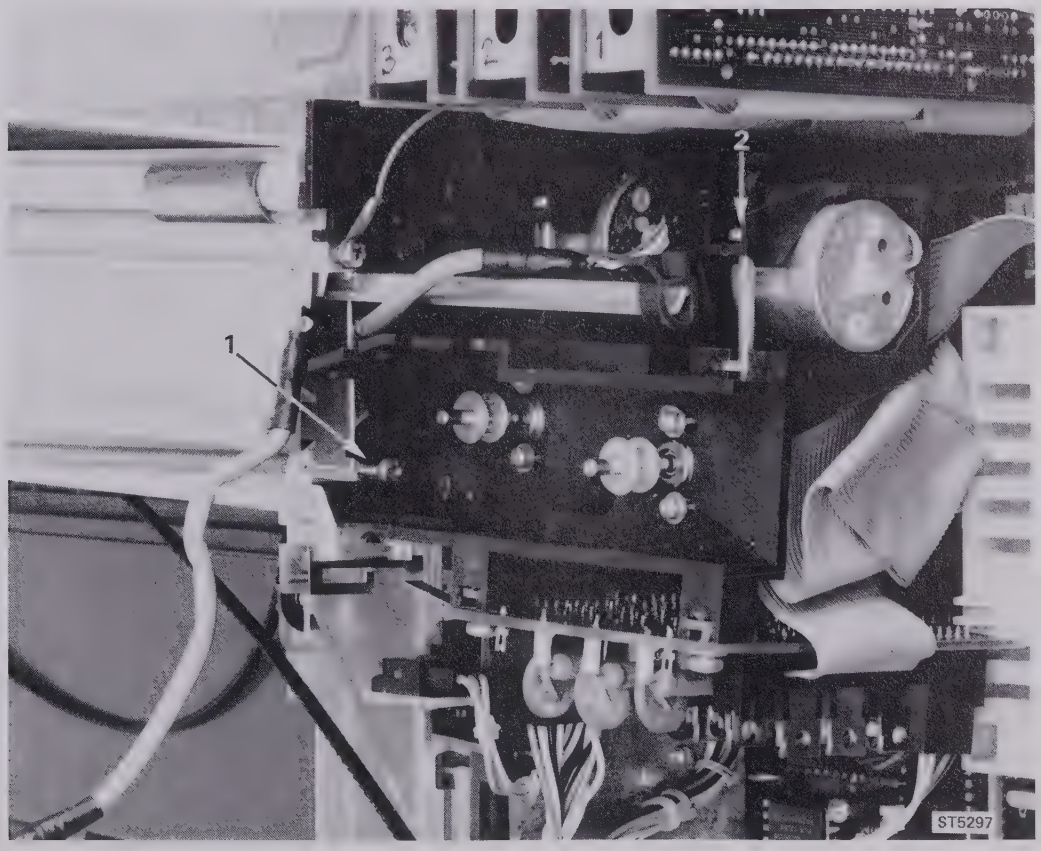


Figure 4.14 Removing the lower potentiometer and pen lift motor

4.2.3 Adjusting the servo unit extrusions

- Place the servo unit on a flat surface (e.g. a table) as indicated in figure 4.15.

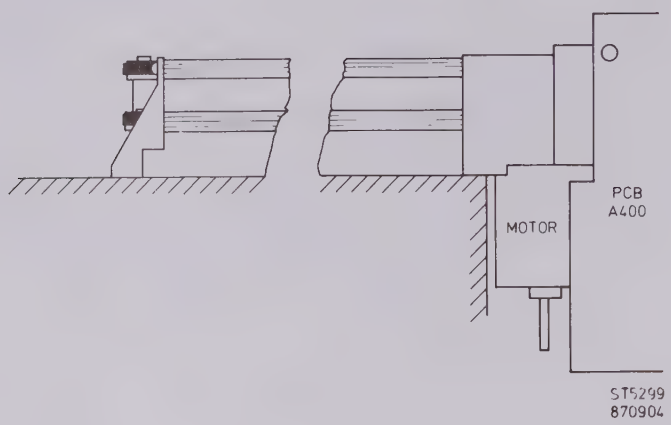


Figure 4.15 Servo unit

- Loosen the 3 crosshead screws (items 1, 2 and 3 in figure 4.16) on both sides of the servo unit

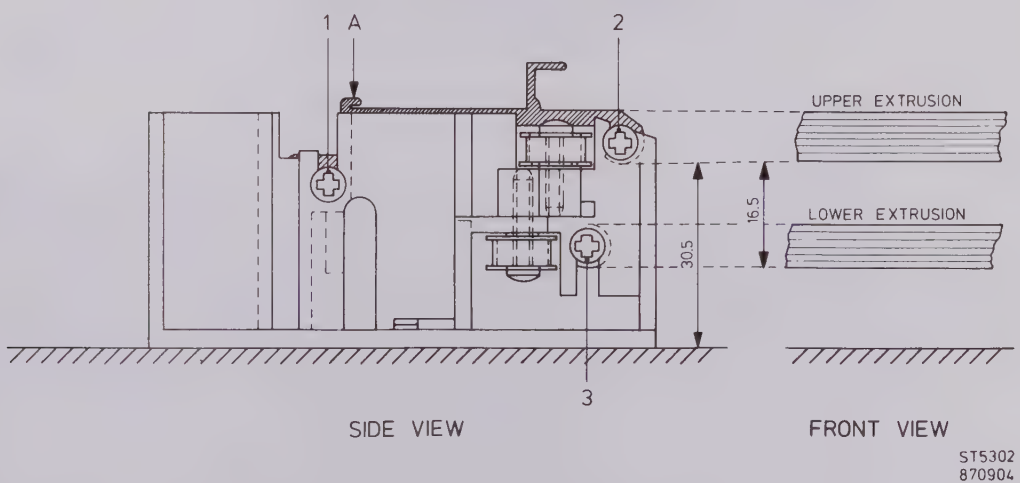


Figure 4.16 Adjusting the servo unit extrusions

- Press the rear (point "A") down and tighten screws 1 tight enough so that the upper extrusion can still be moved

- Adjust the height between the front of the upper extrusion and the surface on which the unit is placed to 30.5 mm and tighten screws 1 and 2 on both sides.

- Adjust the distance between the upper extrusion and the lower extrusion to 16,5 mm, as indicated in figure 4.16. Fix screws 3. You can use the adjusting blocks (1 at each side is the easiest way). The block is drawn in figure 4.17.

Ordering number: 5322 466 61679

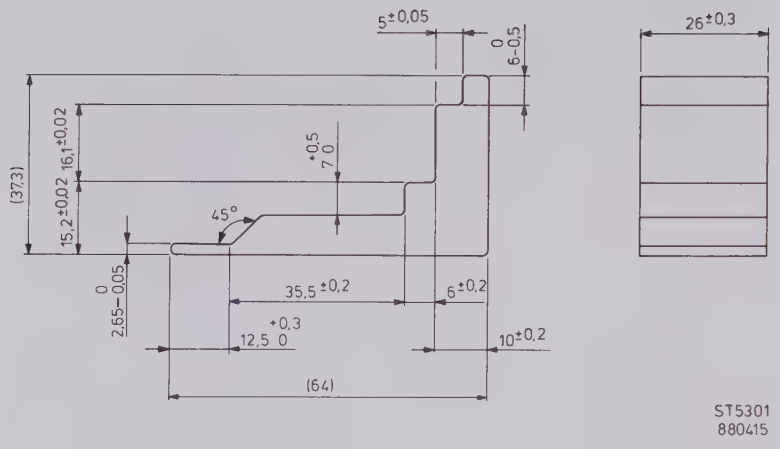


Figure 4.17 Tool for adjustment of the extrusion height

4.2.4 Replacing the servomotor and the toothed belt

- Take off the servo unit (refer to section 3.4).

- The servomotor can be removed after unscrewing three crosshead screws. After replacing the motor, the belt tension has to be adjusted, see below. You must mount washers (2,7x8x0,8) between the screws and the housing (see section 9 point 5).

- The toothed belt can be removed together with the carriage, see 4.2.2. After replacing it, the belt tension has to be adjusted, see 4.2.5.

- Mount the servo unit (see section 3.3.4 for adjustment).

4.2.5 Adjusting the belt tension (see figure 4.18)

- Position the carriage against the left stop

- Push the belt as indicated in figure 4.18 at point A (upper channel) or B (lower channel). The required force to achieve a deviation of 3 mm must be 25...30 gr.
  To change the belt tension, the motor has to be moved.

Ordering numbers:

- Servo motor	5322 361 41013 (equal for both channels)
- Toothed belt 400-t	5322 358 30766 (for upper channel)
- Toothed belt 347-t	5322 358 30765 (for lower channel)

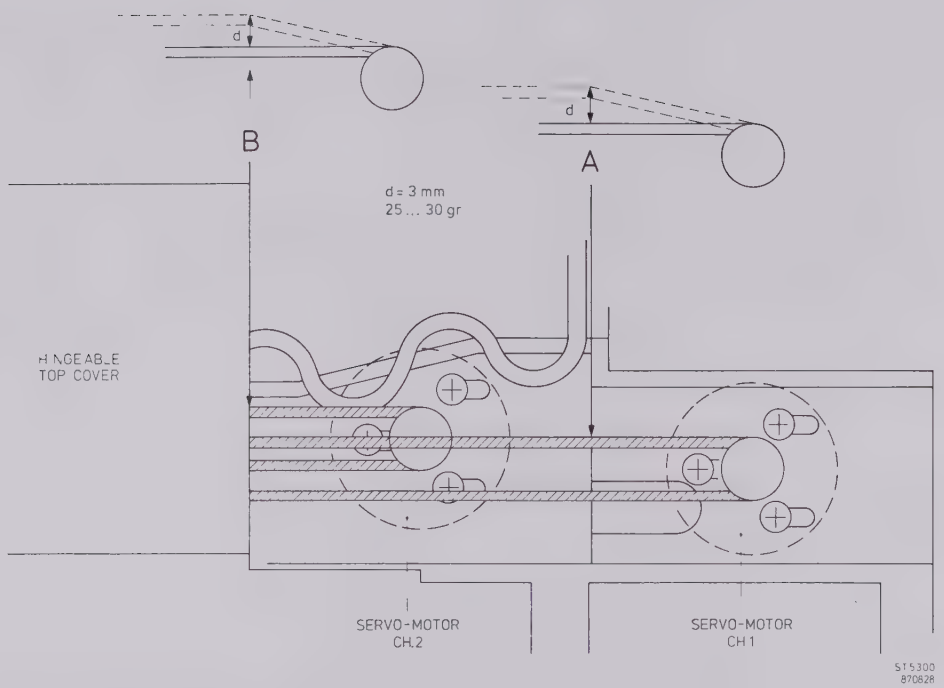


Figure 4.18 Adjusting the belt tension

4.2.6 Removing and mounting the pen lift motor and transmission

- Loosen the motor fixing screw (figure 4.19, item 1) and remove the motor

- Pull off the pen lift transmission of the pen lift bar

To mount the pen lift transmission:

- Lift the pen by rotating the pen lift bar by hand until the transparent pen holder just hits the brown guiding profile (figure 4.12). If the pen is lifted further, the pin for storing the pen protection cap will move; this is not allowed as the carriage will have too much friction then.

- Press the transmission on the lift bar, keeping it in the position as indicated in figure 4.19.

- In the pen up position the liftheight must be at least 3 mm for the upper and 2,7 mm for the lower pen.

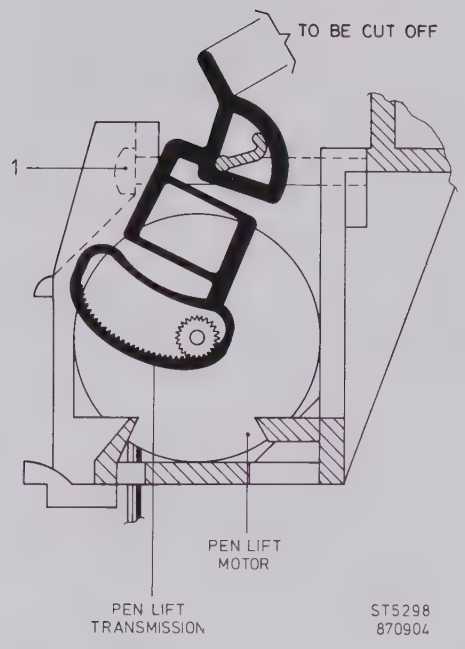


Figure 4.19 Pen lift transmission at "pen up" (left view)

Ordering numbers:

- Pen lift motor	5322 361 41014
- Pen lift transmission	5322 522 10391

4.2.7 Adjusting the friction between liftmotor and transmission

The friction can be adjusted by putting shims under the liftmotor. Normally 2 shims are used. More shims give less friction. The correct friction is, when the pen does not drop more than 0,2 mm after it has been lifted.

4.2.8 Adjusting of the position of the bracket on P.C.B. A400

The distance between the underside of the bracket at the upper-right side of P.C.B. A400 and the housing straight below, must be adjusted to 87 mm. The soldering pin beside the bracket and the bracket should not touch eachother.

4.3 INSTALLATION OF AN INTERFACE CARD

The following interface cards can be installed:

- PM9890/01, RS232-C/V24 interface
- PM9891/02, IEEE 488/IEC 625 interface.

See figure 3.6 for the location of the interface.

Proceed as follows (see figure 4.20):

- Remove the right cover (see section 3.2)
- Remove the CHART DRIVE/SERVO unit (see section 3.3)
- Remove the rear text plate
- Remove the blank part on the text sticker
- Break off the metal strip
- Connect the flat cable, delivered with the interface card, to the interface and connector X111 on the CPU board
- Mount the interface on the rear text plate with the external connector at the lower side.

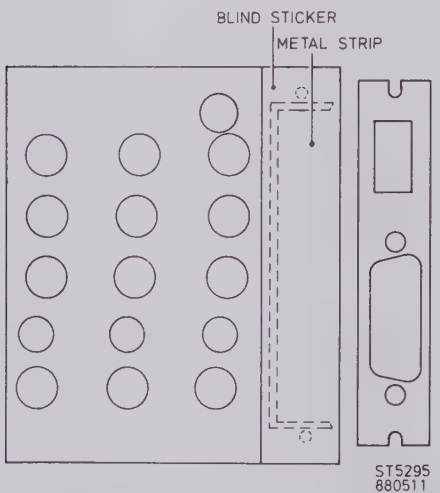
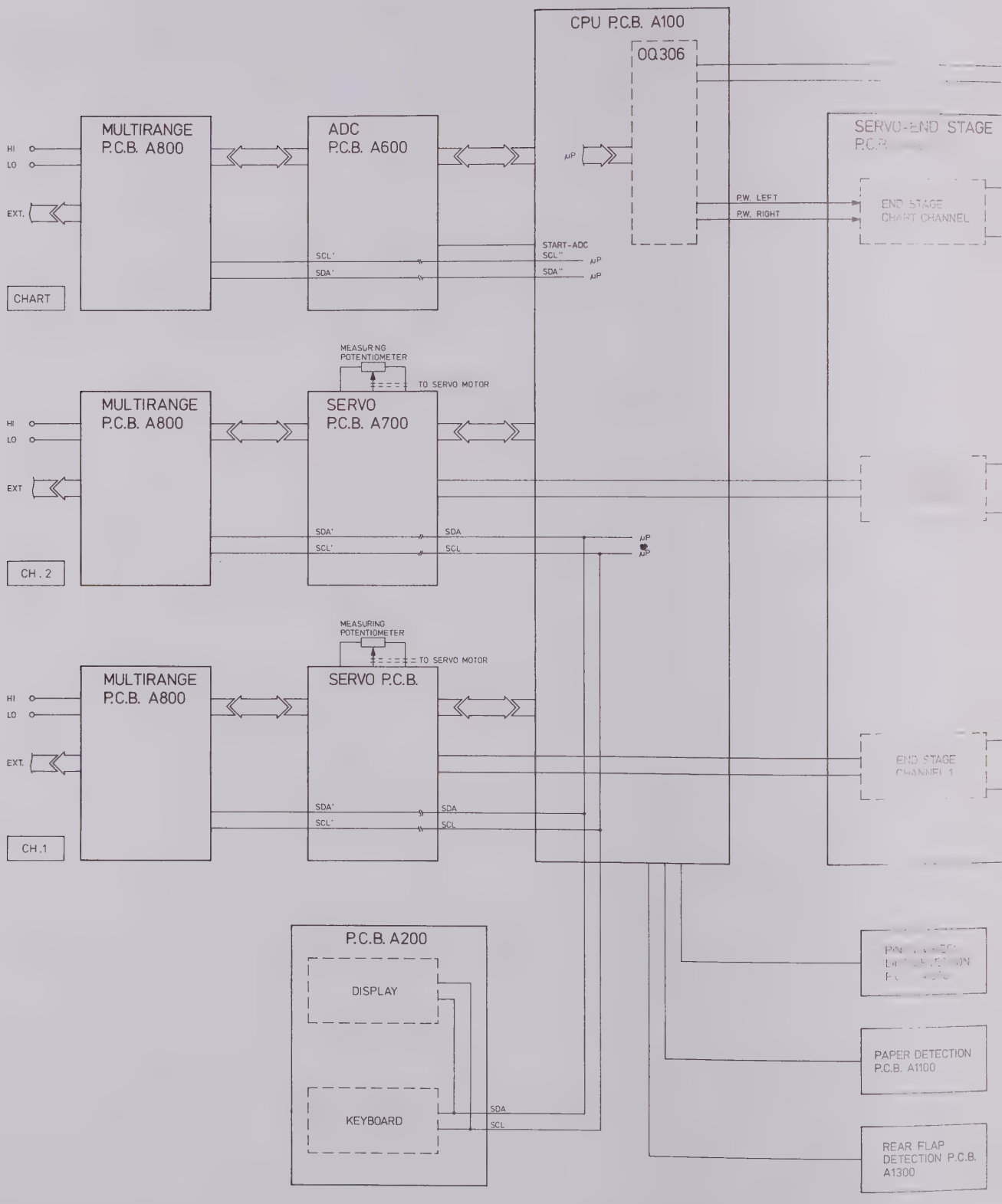


Figure 4.20 Installation of an interface card

5. CIRCUIT DESCRIPTION

Block diagram



5.1 CPU P.C.B. A100

5.1.1 Micro processor

The micro processor has 4 biderectional I/O ports.

Port 0 This port is multiplexed and used for data bus and low order addresses. The low order addresses are latched into D103 by the signal ALE (Address Latch Enable).

Port 1

Pin	Description
1	START ADC
2	1 Pulse/cm, not implemented
3	SELWDOG If the pulses stop, the watchdog circuit will reset the complete system.
4	Chart stop and Servo kill. Active = low; kill = high
5	SCL"
6	SDA"
7	SCL: Clock line of the IIC bus
8	SDA: Data line of the IIC bus

Port 2 Port 2 is used for the high order address lines.

Port 3 Port 3 is used for several functions.

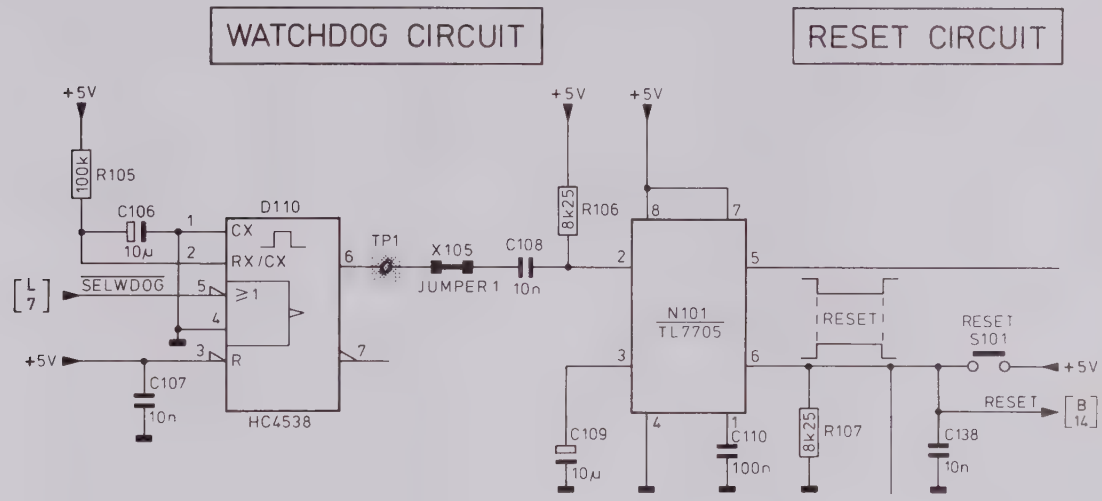
Pin	Description
10/11	Used for lifting the pens. PEN UP = LOW ("0") PEN DOWN = HIGH ("1")
12	Not implemented.
13	Interface interrupt.
14	Pin 14 is used in the test mode. Jumper 3 is installed ==> Normal operation Jumper 3 is removed ==> Signature analyses test Pin 14 gives the start and stop pulses.
15	Input line for external CHART CLOCK pulses.
16	$\overline{RD}$ } The RD and WR must show activity
17	$\overline{WR}$ }

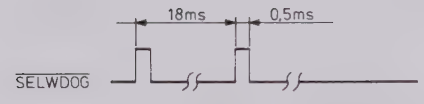
The rest of the pins

9	RESET input.
10	Input clock signal (from the ADC IC).
29	PSEN (Program Store ENable). This signal is used to enable the ROM.

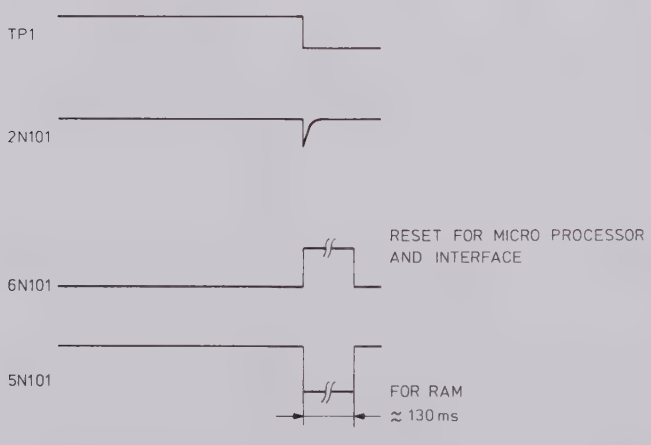
5.1.2 WATCHDOG and RESET circuit

When the system is functioning normally, IC D110 gets the signal SELWDOG. If this signal stops, the output pin 6 (TP1) changes from "1" to "0". This falling edge triggers N101 and the result will be a RESET pulse. The RESET pulse resets the complete system.



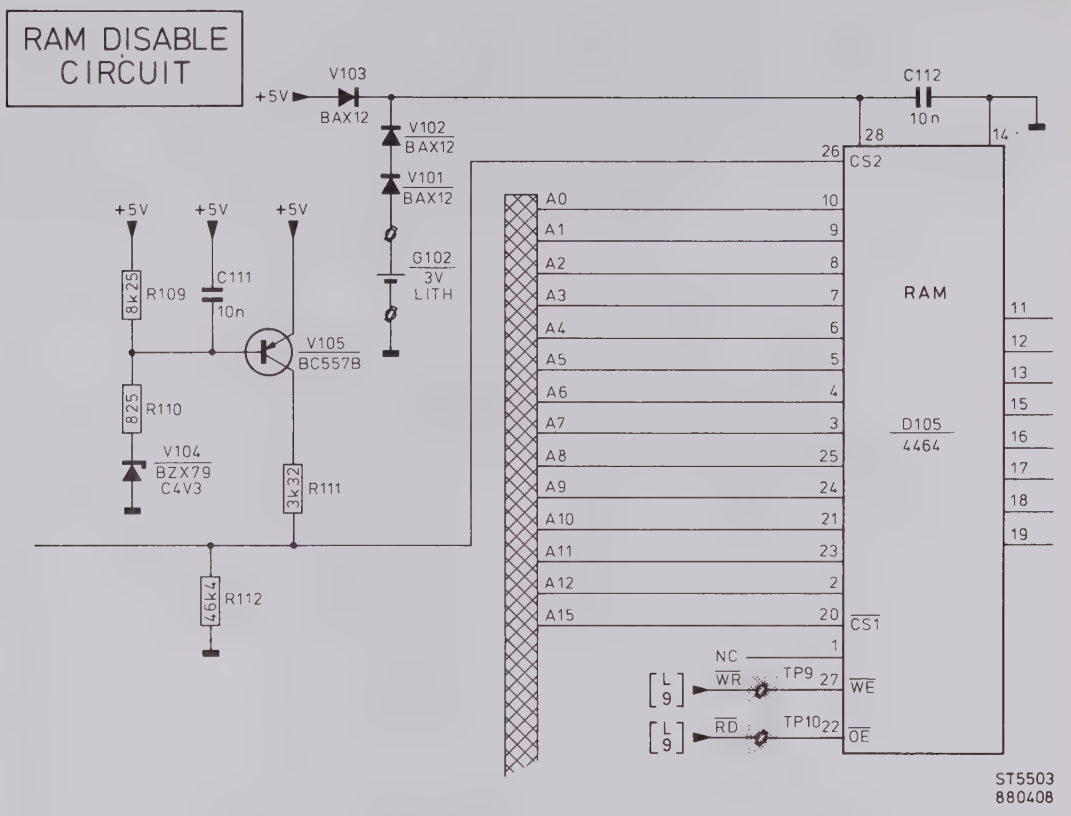


SELWDOG is only regular in the TX mode.



During POWER UP: 6N101 is "1"
5N101 is "0"

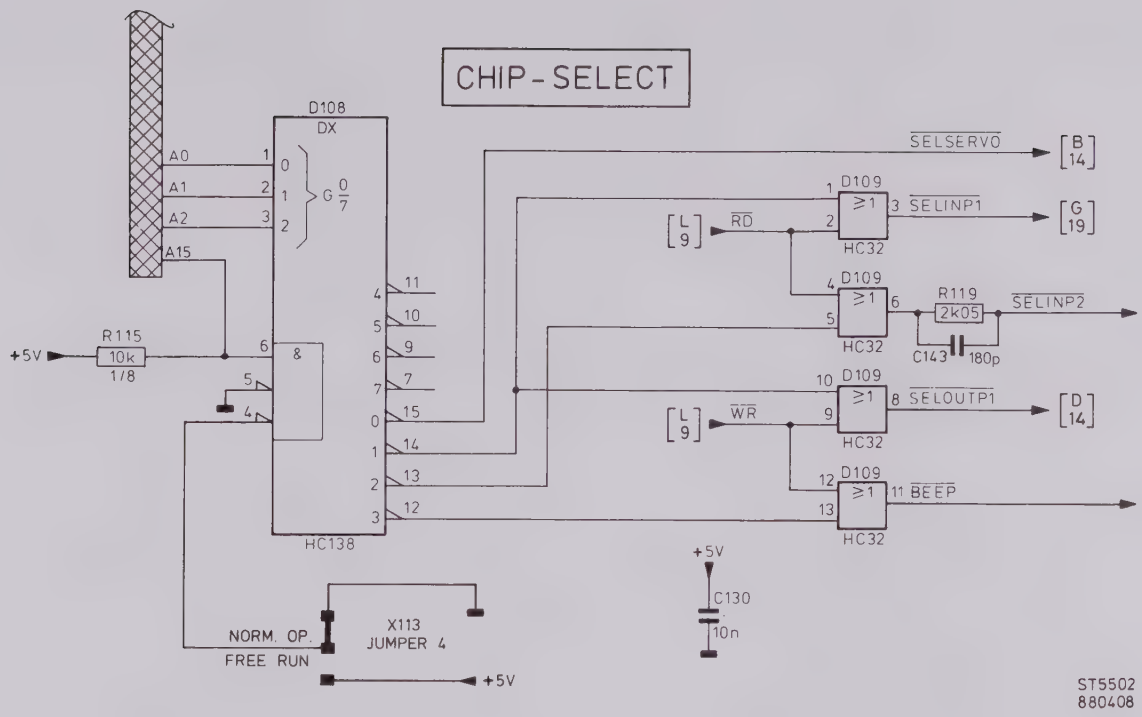
5.1.3 RAM DISABLE circuit



- V105 starts conducting when the +5 V supply exceeds 4 V.
- Via V105 and R111 CS2 can get "1" and then the RAM is enabled.
- The RAM has a memory back up, G102, V101 and V102 perform this function.

5.1.4 Chip select

With D108 the various I/O functions can be selected. Addressline A15, if "1", enables D108. Addresslines A0, A1 and A2 select the different I/O functions.



Pin	Description:
12D108:	If "0" and $\overline{WR}$="0" then D110 is enabled (BEEP).
13D108:	If "0" and $\overline{RD}$="0" then $\overline{SELINP2}$="0". This selects input 2 (1/2 D107, D112).
14D108:	IF "0" and $\overline{RD}$="0" then $\overline{SELINP1}$="0". This selects input 1 (D106).IF "0" and $\overline{WR}$="0" then $\overline{SELOUTP1}$="0". This selects output 1 (1/2 D107, D112).
15D108:	$\overline{SELSERVO}$ "0" servo IC D101 selected. "1" READ and WRITE I/O D101 disabled.

Functions input 1:

- front of paper detection
- rear of paper dection
- pinch wheels lifted detection
- rear flap down detection
- CH 1, CH 2, chart channel ==> servo fail detection

Functions input 2:

- servo kill, pen up/down — CH 1
- servo kill, pen up/down — CH 2
- chart clock INT/EXT
- Forward/Reverse
- Page/Return
- Start/Stop

Functions output 1: eventmarker Ext/Remote
MARK
kill CH 1
kill CH 2
TL 1
TL 2
TL 3
} ==> LED's for test functions
TP 4 1

5.1.5 Galvanic separation

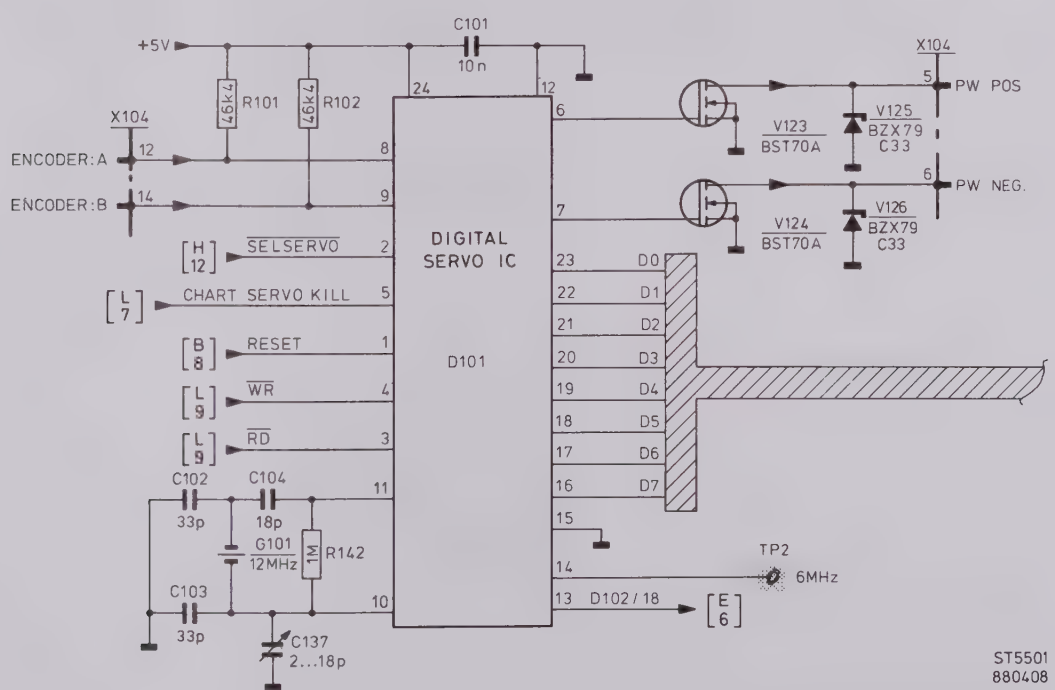
- The pulses for the servo systems of channel 1 and 2 are separated by opto couplers H102-H108. The pulses are then shaped by the comparators N102-N103. The shaped pulses are sent to the Servo and End Stage P.C.B. A400.

5.1.6 Digital servo IC OQ0306

The OQ0306 serves as an interface between a digital servo control system and the micro processor bus.

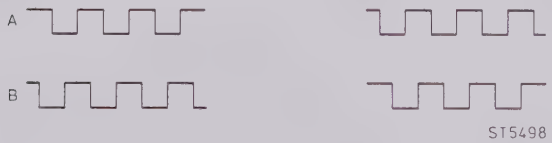
Functions:

- Conversion of the pulses from the optical encoders into position and direction information.
- Generation of pulse-width programmable pulse trains of base-frequency. To be used for direct control of a pulse-width driven power amplifier for a DC-servomotor.
- Clock circuitry, including a crystal driven oscillator and as many dividing stages as necessary to achieve a signal with a frequency of 1/512 of the crystal frequency.



Pin	Description
1	Reset
2	Enable servo IC
3	RD: When "0" data can be read
4	WR: When "0" data can be written
5	Chart servo kill
6	Positive pulse for the servo end stage
7	Negative pulse for the servo end stage
8	Pulse from encoder A
9	Pulse from encoder B
10	} crystal connections. Frequency 12 MHz.
11	}
12	Zero
13	Clock frequency devided by four
14	Clock frequency devided by two
15	Test mode
16-23	Data bus
24	5 V supply

Input signals from the encoders.

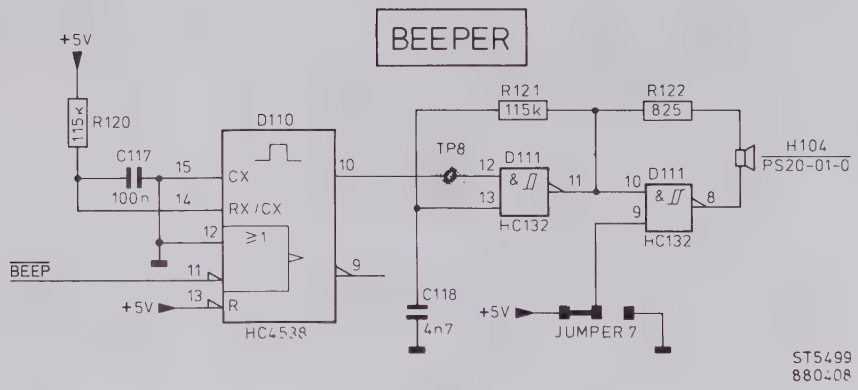


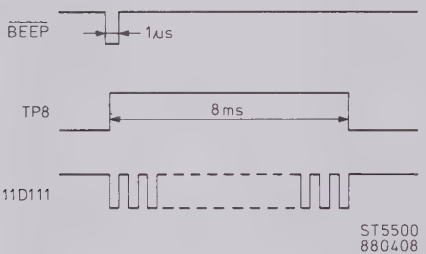
motor C.W. chart reverse

motor C.C.W. chart forward

The encoder signals give the servo IC information about the amount of motor shaft rotations and direction of rotation (see phase in the above figure). The pulse is shifted into the internal up/down counter. The counter is read by the micro processor and this value is compared with the desired position. The micro processor programs the pulse generator in the servo IC to send the required pulse width to the servo power stage.

5.1.7 Beeper

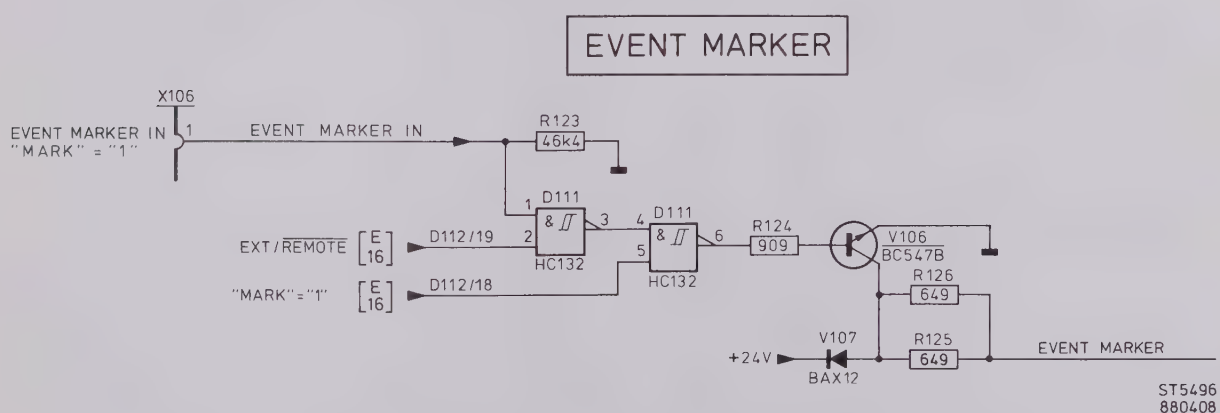




The Beeper oscillator is activated by a "1" from the monostable oscillator D110. You can switch it off by jumper 7.

5.1.8 Event marker

The event marker (accesory PM9870/10) can be activated via the interface or directly via the the external connector, when EXT/REMOTE 2D111 is "1". Selecting EXT/REMOTE is done via the interface.



External event marker control:

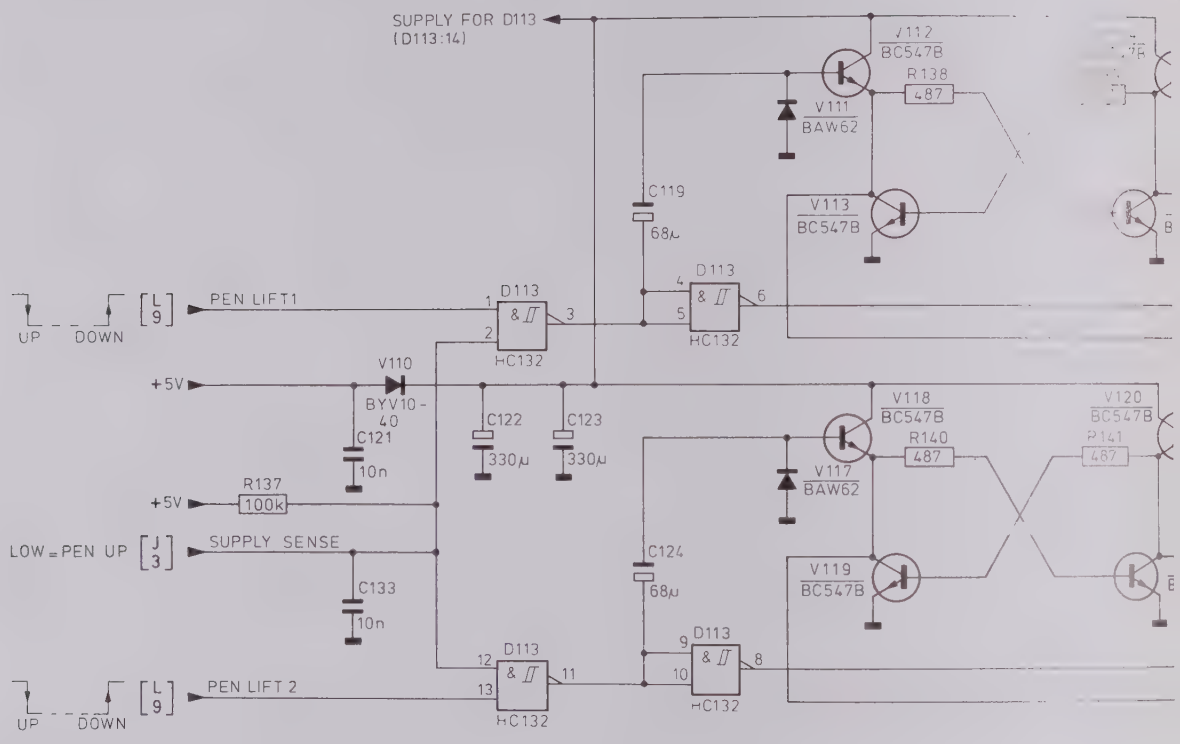
2D111= "1"
1D111= "1" or "0"

4D111= "1" or "0"
5D111= "1"

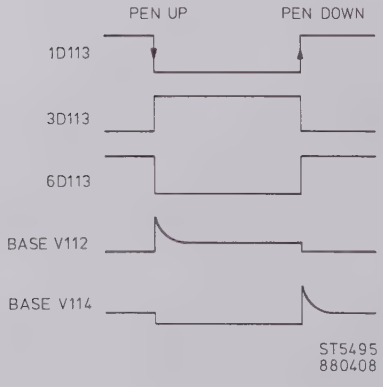
6D111= "1" or "0"

Remote event marker control (via interface).
2D111 "0" ==> 4D111= "1" } ==>6D111= "1" or "0"
5D111= "1" or "0" }
"MARK"="0" ==> solenoid energised.

5.1.9 Pen lift circuits



The liftmotor is only energised during lifting and lowering of the pen. Pen commands will only be possible, when "supply sense" is "1" (2D113 and 12D113). When "supply sense" changes to "0" (for instance after switching off the power), the circuit has power enough to lift the pens

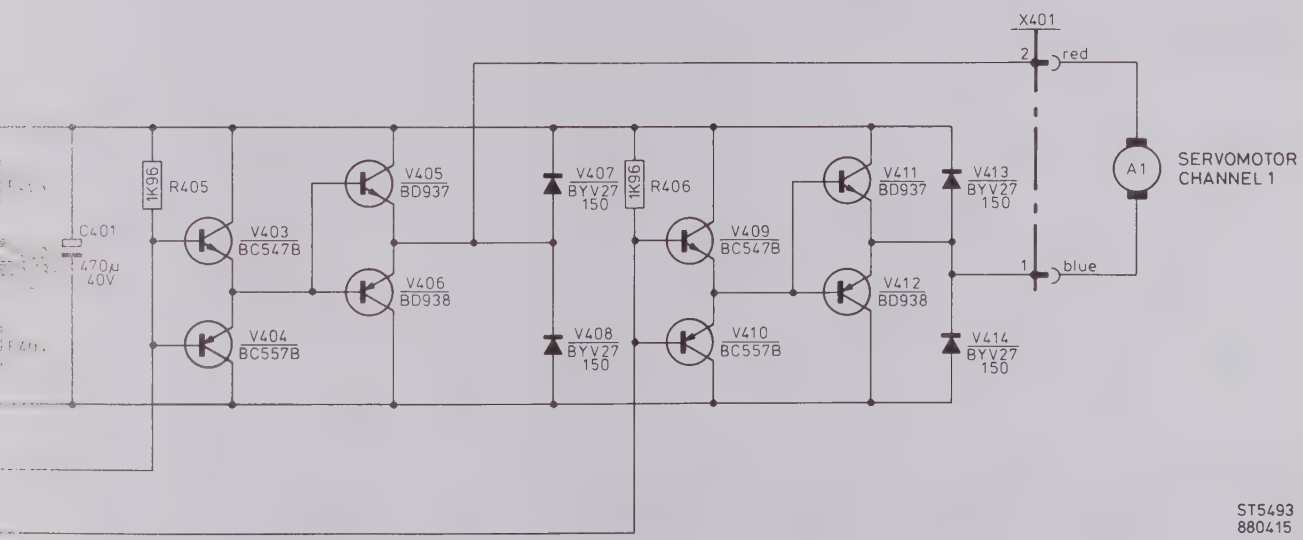


5.2 Display keyboard P.C.B. A200

D204 is an I/O IC for the I^2C bus (see figure 11.8 at page 11-12). It can read the keyboard switches. The information is sent to the micro processor via the I^2C bus.
D201-D203 are I^2C bus IC's to drive the LCD's.
C201 and R205 are connected to D203 to use the internal oscillator.

Signals drivers:
- SCL/SDA : Data for the internal registers
- S1-32 : Multiplexed output data for the display
- BP1, BP2: Back plane signals
- A0, A1 : Hardware oscillator input

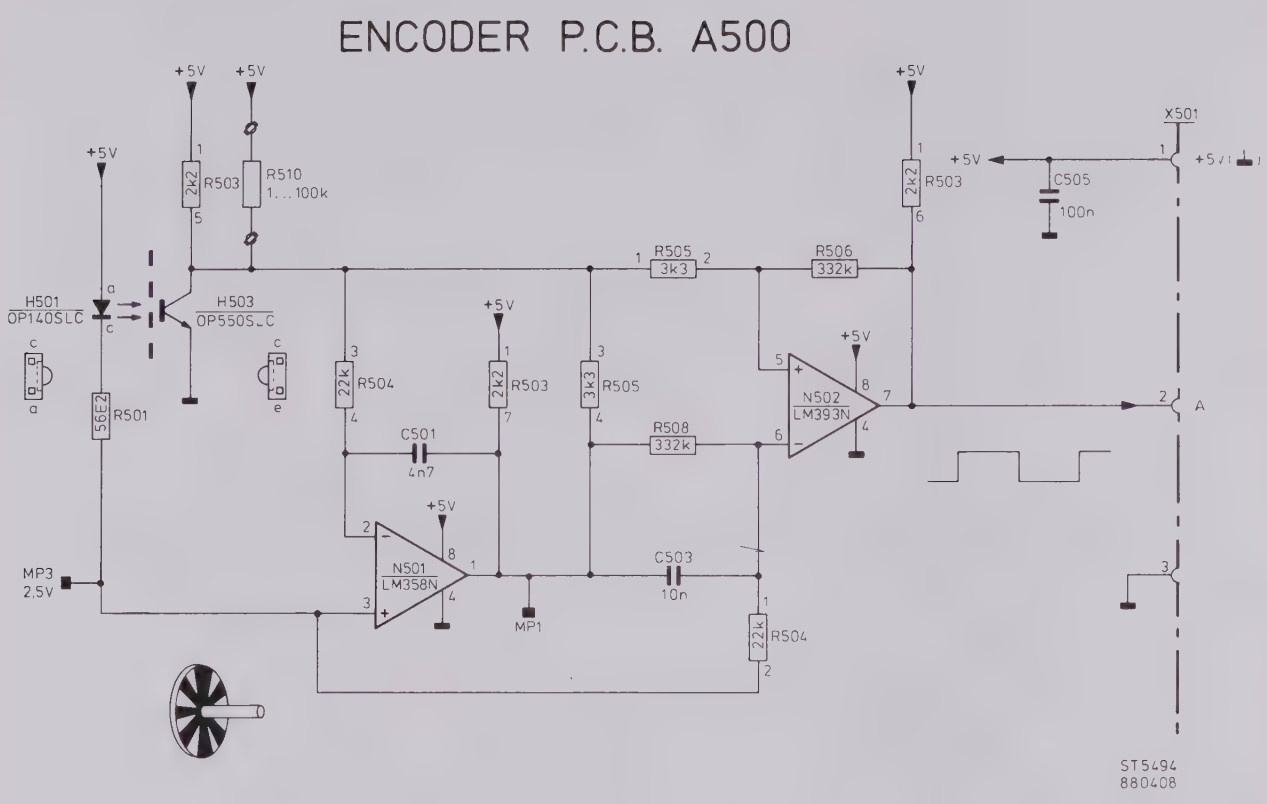
5.3 SERVO END STAGE P.C.B. A400



In balance the output from the galvanic separation is:
AMPL.PW LEFT = 24 V
AMPL.PW RIGHT= 24 V
Transistors V403, V405, V409 and V411 will be open so the motor has 24 V on both sides and is not energised. Depending on the direction of rotation required, there will be negative pulses at one of the lines AMPL.PW LEFT or AMPL.PW RIGHT and transistors V404 and V406 insteat of V403 and V405 or V410 and V412 instead of V409 and V411 will conduct. The width of the pulse is depending upon the magnitude of the desired displacement of the carriage. This width detemines the average exitation of the motor.

R402 is a PTC. It is used as a current limit. When Vm is approx. 14 V, V401 stops conducting. This causes a SERVO FAIL (20X408 is "1").

5.4 ENCODER P.C.B. A500



The rotation of the encoder disk between the LED and the light sensitive transistor causes a kind of sine function at the collector ofH503 and H504. This signal goes to integrator N501 (1, 2, 3) and comparator N502(5, 6,7). The integrator is used to stabelize the switching characteristics of the comparator, independant of the aging of the opto coupler. The comparator transforms the sinewave to a TTL signal.

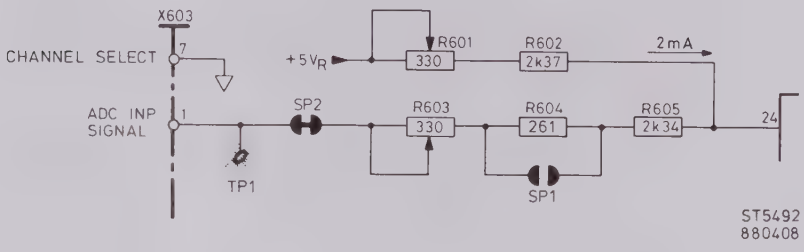
The output signals A and B (pin 2 and 4 of X501) have a phase difference of 90^0. The digital servo servo IC D101 uses the phase difference to recognize the direction of rotation.

5.5 ADC P.C.B. A600

5.5.1 ADC

A 14 bit Successive Approximation ADC is used.
Input: The full input range is 4 mA.
Input circuit:

$-5\ V \leqq Vi$ (ADC input signal) $\leqq +5\ V$



In recorders a symmetrical signal around zero is used. That's why half the input current is injected via R601 and R602. The Table shows the results of the ADC.

Table ADC

Vi [V]	Iin [mA]	IADC [mA]	ADCout binair
-5	-2	0	0
0	0	2	8192
+5	+2	4	16384

Conversion ADC

The ADC start pulse is generated by the micro processor. This pulse is sent via the opto coupler and flip-flop D601 to the ADC (for the different signals see section 6.1.6). After the start pulse, BUSY changes to a "1" and the ADC sends the converted dc-signal as a 14 bitsdigital signal, starting with the MSB. The output is shifted into shiftregister D605 by the 14 clockpuses from the ADC. The BUSY signal controls, via D603 (11, 12, 13) and D603 (8, 9, 10), whether the clock signal of the ADC or the higher clock signal from the micro processor (via A602, the opto coupler, A601 and D604) can reach D605. The clock from the micro processor is used to shift the data out of D605. The micro processor uses the serial data to generate an 8 bit signal for the digitaal servo IC.

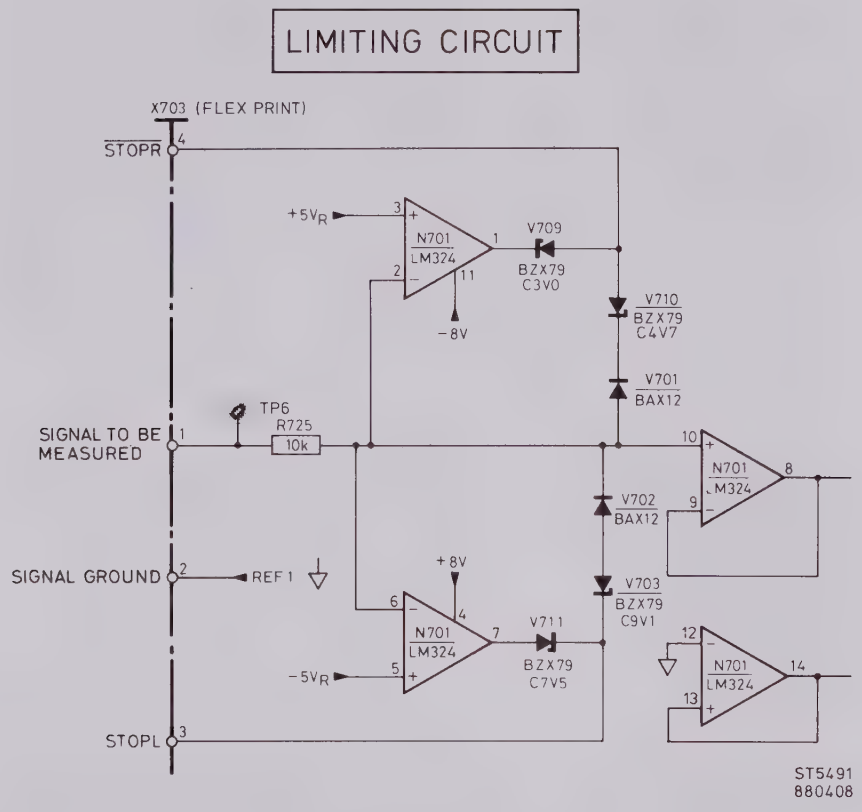
D604 multiplexes the clock and data lines. So the data lines can be used for different functions at the multirange P.C.B. too. The "start ADC line" switches the MUXDX.
The rising edge of the ADC start pulse is the clock pulse for D601. The first clock pulse of the ADC resets D601.

5.5.2 Galvanic separation

The galvanic separation is done by two special OQ IC's and four opto couplers.

5.6 SERVO P.C.B. A700

5.6.1 Limiting circuit



Normal sitiation: $-5\ V \leqq V_{TP6} \leqq +5\ V$.

1N701 is approx. + 8V. It functions open loop because V701 does not conduct. STOPR is 8-3,3=4,7 V.

Limit situation (+): $V_{TP6} > +5\ V$

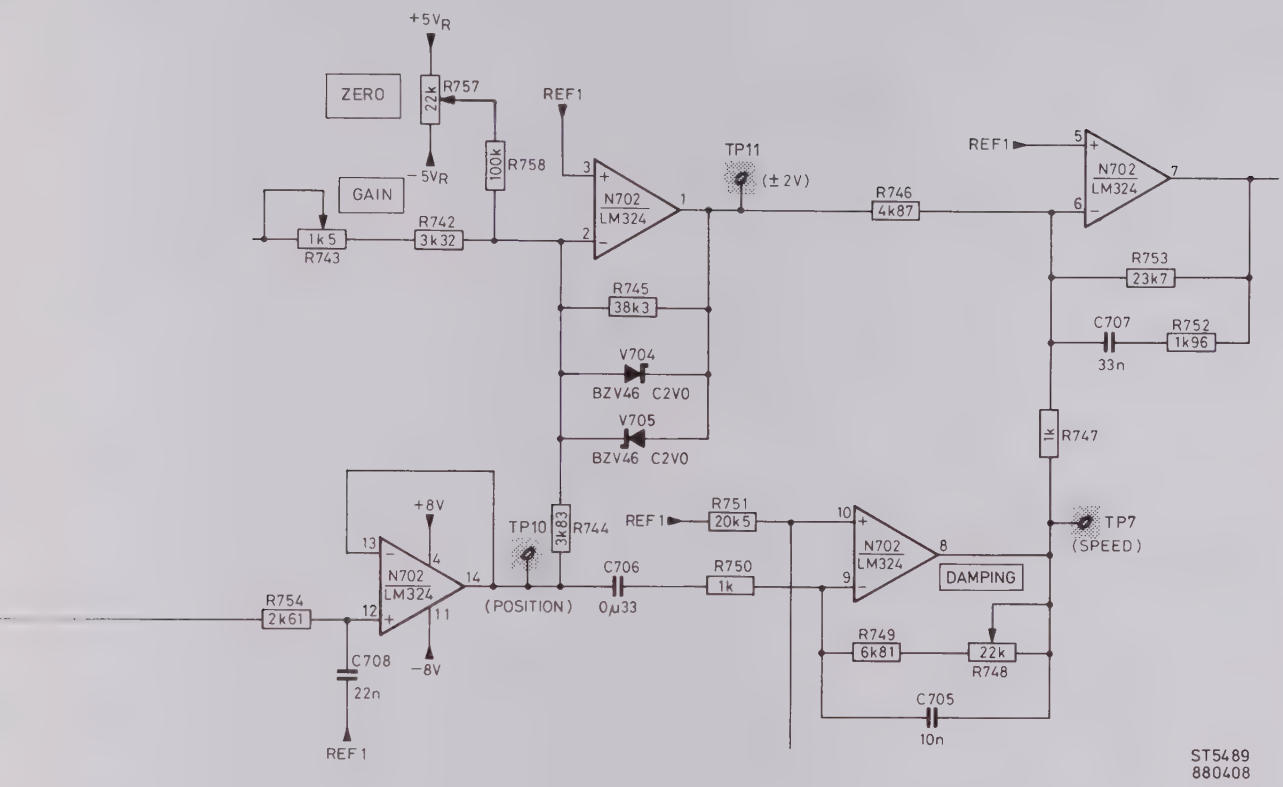
N701 functions closed loop. This means 3N701=2N701=+5 V and STOPR= 5-0,7-4,7= 0 V approx.

7N701 is approx. - 8V. It functions open loop because V702 does not conduct. STOPL is -8+7,5=0,5 V.

Limit situation (-): $V_{TP6} < -5\ V$

N701 functions closed loop. This means 6N701 =-5 V and STOPL= -5+0,7+9,1= 4,8 V approx.

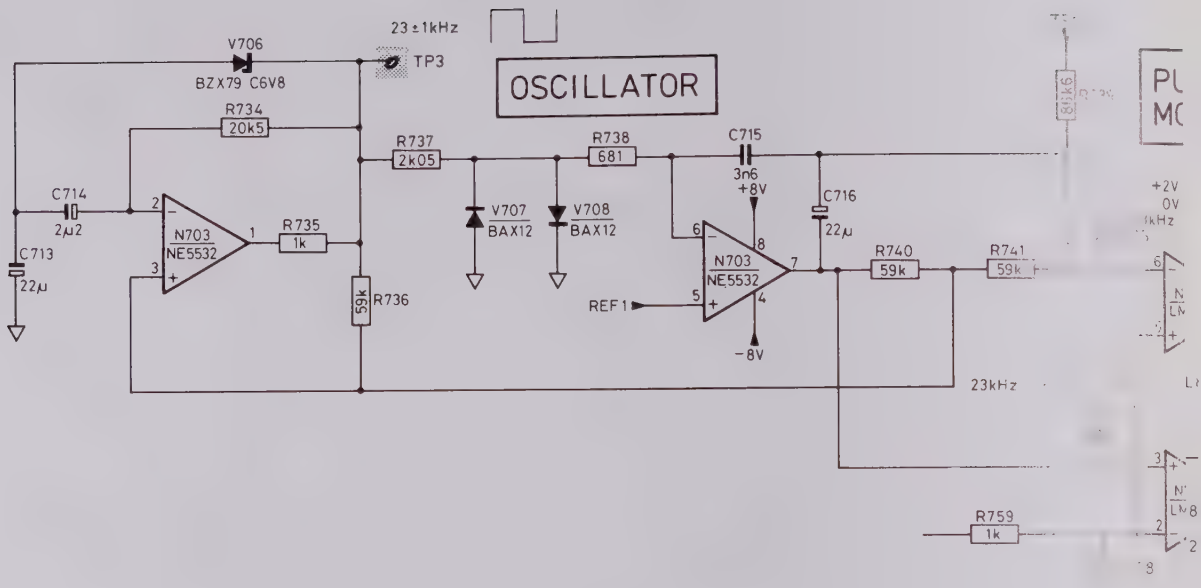
5.6.2 Balance system



After the limiting circuit the signal is buffered by N701 and added to the buffered signal from the measuring potentiometer. Adding is done by N702 (1, 2, 3). The output of N702 is clamped by V704/V705 to ± 2 V. In balance the output of 1N702 (TP 11) should be 0 V approx.

N702 (8, 9, 10) differentiates the signal from the measuring potentiometer. It is used as speed dependant feed back for the servo system and added to the difference signal between the position and the input signal.

5.6.3 Oscillator

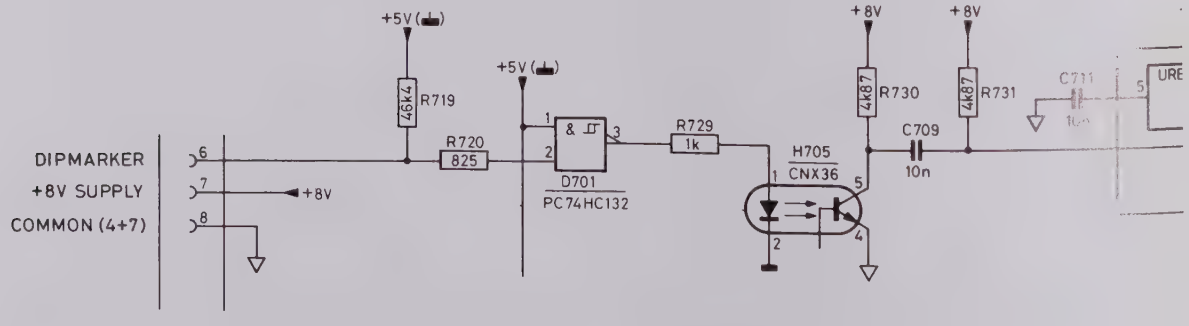


The oscillator is used to make the triangle waveforms for the pulse modulator.

5.6.4 Pulswidth modulator

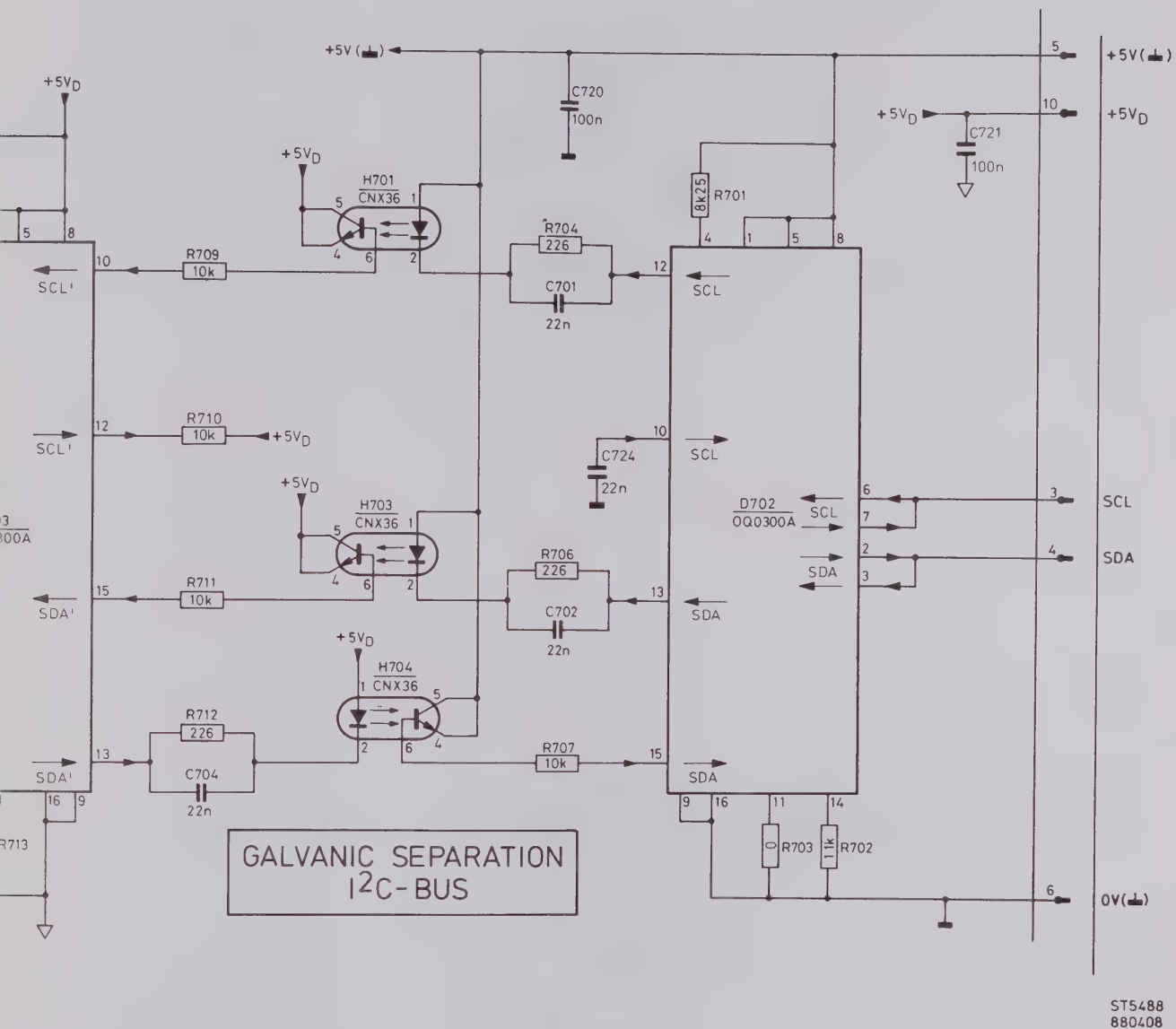
The DC position error signal is compared with the positive and negativetriangle. The switching point of this comparation defines the duty cycle of the output 5N704.

5.6.5 Dipmarker



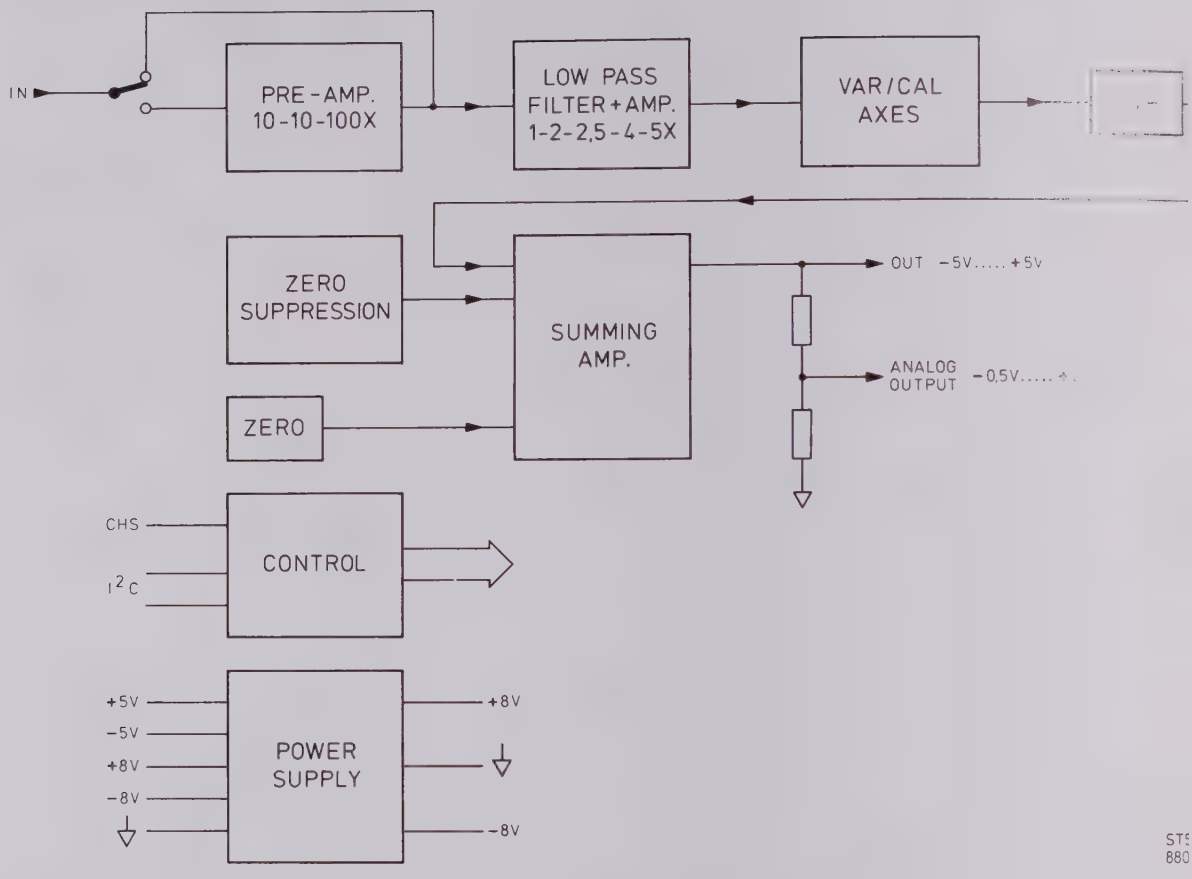
The dipmarker is a monostable oscillator. It is activated via opto coupler H705 and D701(1, 2, 3) by a "0" at the external input connector.

5.6.6 Galvanic separation I^2C bus



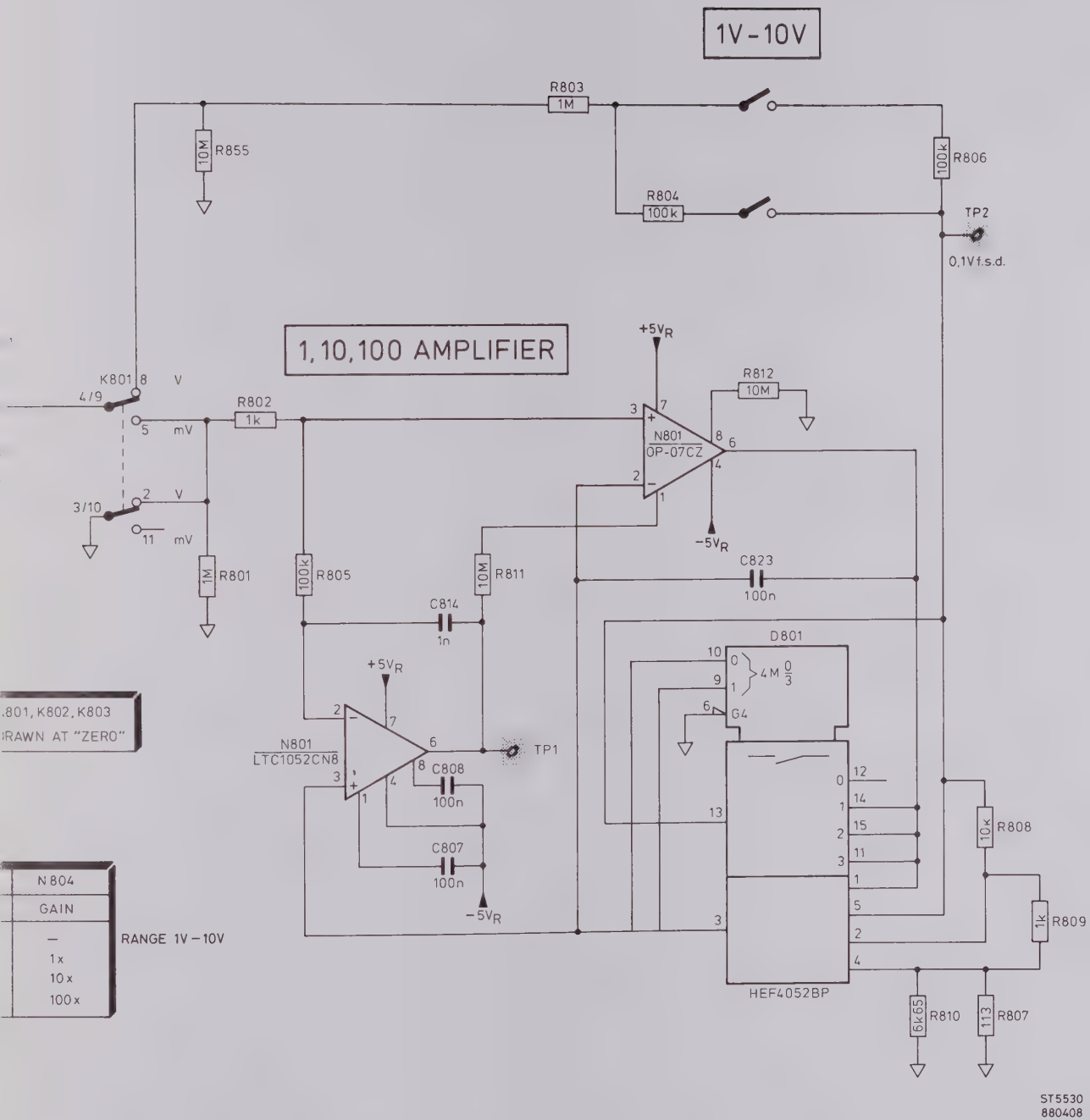
A701 and A702 are special IC's and with the opto couplers it gives galvanic separetion to the I^2C bus.

5.7 Multirange P.C.B. A800



Blokdiagram

5.7.1 Pre-amplifier



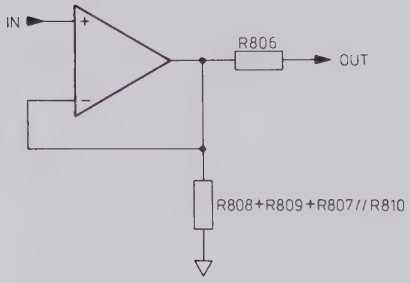
N801 measures the offset voltage of N804 and adjusts this voltage to zero.

In the 1 V and 10 V range the pre-amplifier is not used. The input of N804 is switched to zero and the output is removed from the voltage divider.

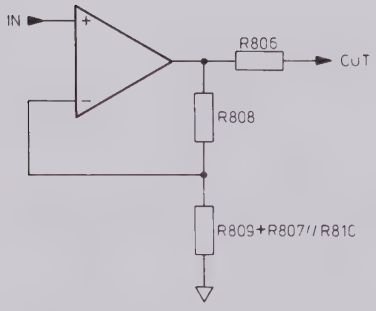
10 V range $\quad Vout = Vin \times \frac{R808+R809+R810//R807}{R803+R804+R808+R809+R810//R807} = \frac{1}{100} Vin$

1 V range $\quad Vout = Vin \times \frac{R806+R808+R809+R810//R807}{R803+R806+R808+R809+R810//R807} = \frac{1}{10} Vin$

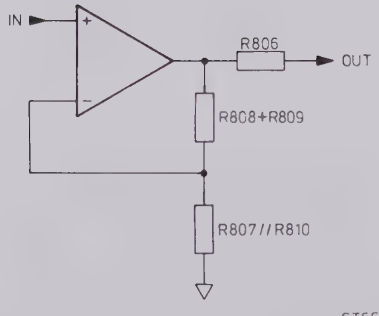
The amplification factor is selected by D801



D801
13 connected to 14
3 connected to 5



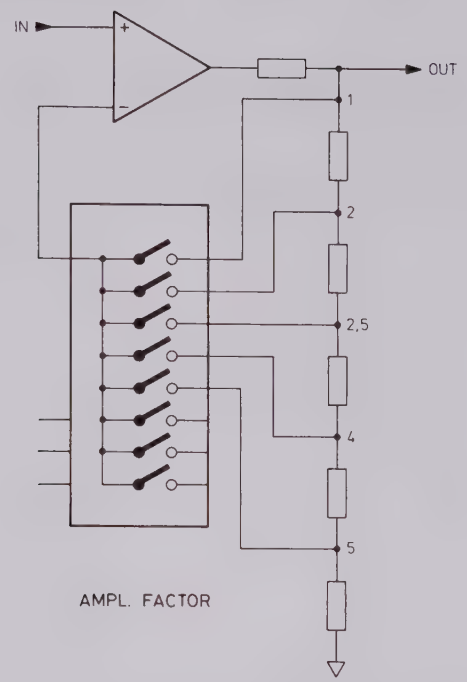
D801
13 connected to 15
3 connected to 2



D801
13 connected to 11
3 connected to 4

ST5522
880408

5.7.2 1, 2, 2.5 ,4 ,5 Amplifier

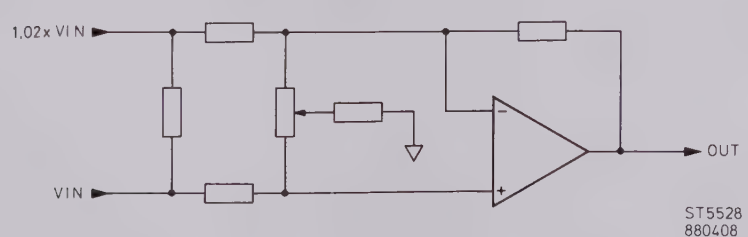


Simplified diagram

Via D802 the resistors R818-R822 are selected to give the correct amplification of N802.
Via potentiometer R825 an extra voltage is injected to correct the offset voltage at TP3.

5.7.3 Variable Span

The connections in D803 are: 5 connected to 4
1 connected to 15

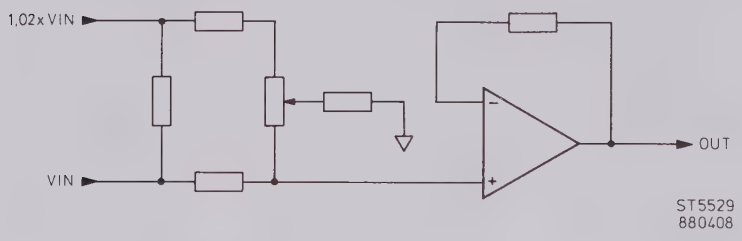


Simplified diagram

The amplification factor can be changed from 0,98 to 2,24.

5.7.4 Calibrated Span

The connections in D803 are: 3 connected to 4
1 connected to 15

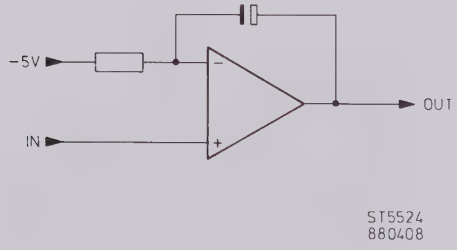


Simplified diagram

The amplification factor is 1.

5.7.5 AXES

The connections in D803 are: 3 connected to 4
2 connected to 15

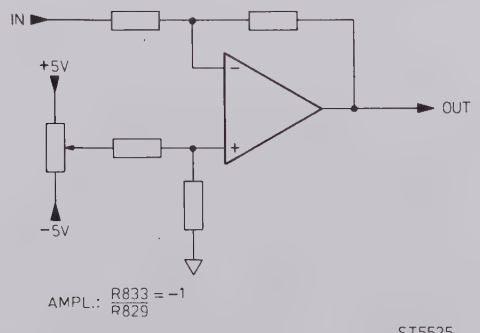


Actions after pressing the key "AXES" or sending the command for axes via the interface:

1- Fast movement of the carriage to the left stop;
2- Slow movement of the carriage to the right stop;
3- Fast movement of the carrriage to the original position;
4- Fast movement of the paper to the forward stop;
5- Slow movement of the paper to the stop in the reverse direction;
6- Fast movement of the paper to the original position.

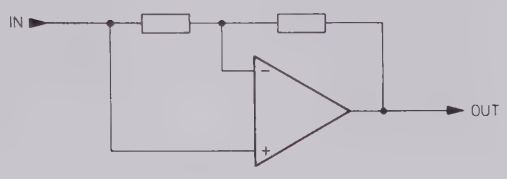
5.7.6 +SPAN

The connection in D803 is: 12 connected to 14



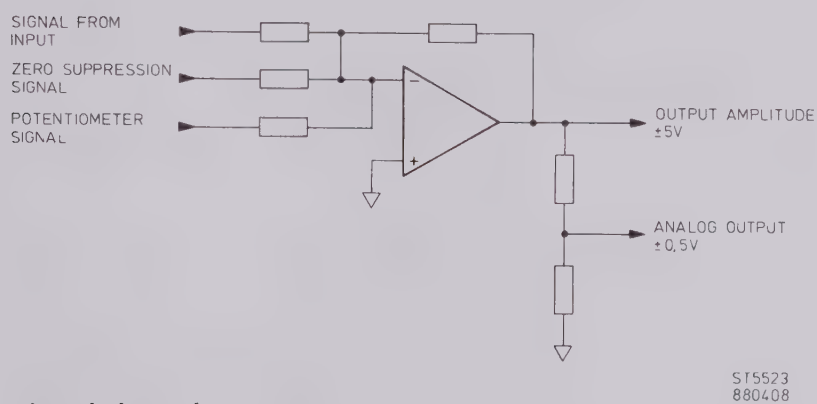
5.7.7 -SPAN

The connections in D803 is: 13 connected to 14



V801 and V802 are to limit the signal at TP4.

5.7.8 SUMMING AMPLIFIER



Simplified diagram

The summing amplifier adds the signals Vin, zero suppression voltage and the voltage from the zero potentiometer.

5.7.9 Zero Suppression

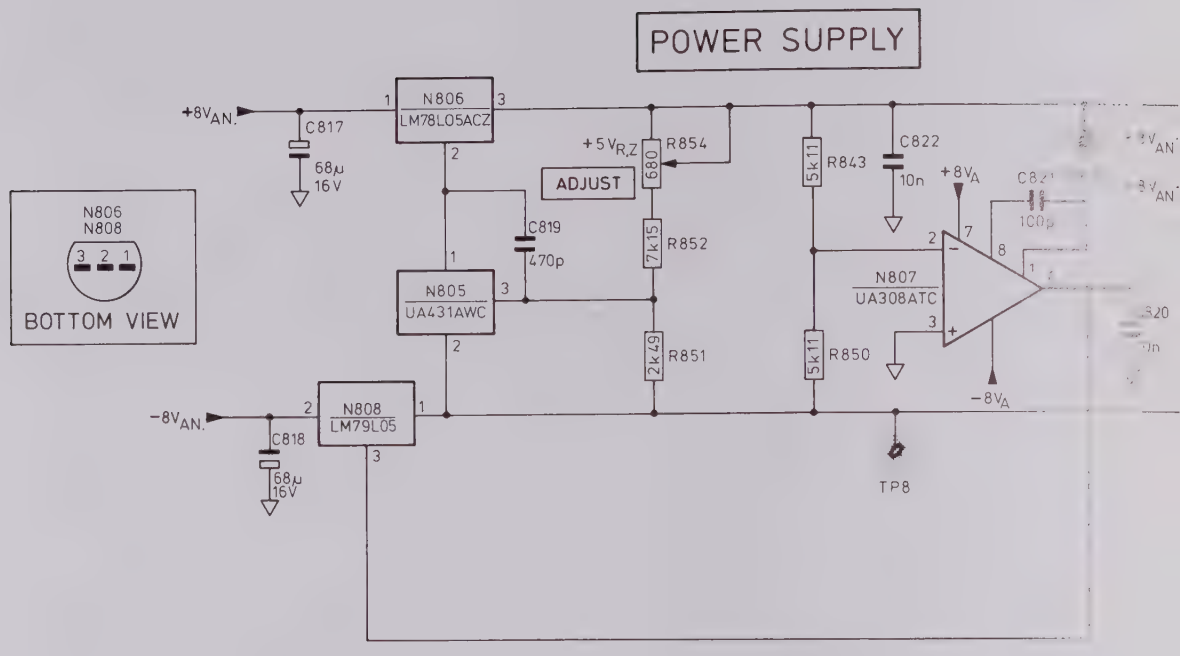
The zero suppression voltage is generated by the attenuator R862, R863, R844-R849. The correct voltage is selected by D804 and buffered by N803.

5.7.10 Control signals

Description of output pins:

IC	Pin	Description
D805	P0	selection preamplifier
	P1	
	P2	selection 10 V
	P3	selection 1 V
	P4	selection 1, 2, 2.5, 4, 5 amplification
	P5	
	P6	
	P7	selection SPAN VAR/ SPAN CAL., AXES D806
D806	P0'	selection zero suppression
	P1'	
	P2'	
	P3'	selection AXES / SPAN VAR., SPAN CAL.
	P4'	selection SPAN+ / SPAN-
	P5'	selection V/mV
	P6'	STOP LEFT overload signal left
	P7'	STOP RIGHT overload signal right

5.7.11 Power supply



Input voltages: $+8\ V_{AN}$ ==> +8 V
$-8\ V_{AN}$ ==> -8 V

At first the +8 and -8 V are reduced to ±5 V by two regulators N806 and N808. The + and - 5 V should have the same amplitude. This is regulated by N807 and N805. On N805 the voltage between pin 3-2 is compared with an internal Vz. Depending on the comparison N805 sources a current on pin 1. The voltage between pins 3-2 can be adjusted by R854. This means, that the +5 V can be adjusted by R854.
N807 compares the middle of the + and - 5 V (0 V) with zero. The output signal of N807 controls the output of N808.

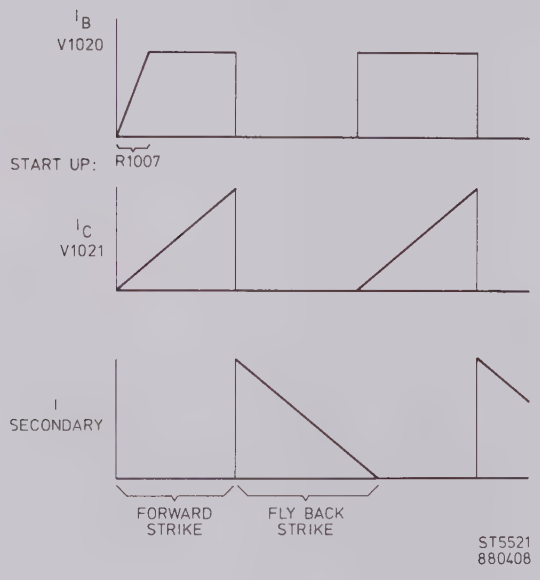
5.8 POWER SUPPLY A1000

Principle of operation

The switched mode power supply consisits of a primary and a secundary converter (see overall diagram page ....).

5.8.1 Primary converter

The converter has two states, the forward strike and the fly back strike:
- During the forward strike energy is loaded into the transformer.
- During the fly back strike energy from the transformer is transferred to the secondary circuit.



5.8.1.1 Start-up, forward strike

- To start the converter, base current for the darlington V1020/V1021 is supplied via resistors R1002, R1003, R1007. Voltage across R1007 is clamped by diodes V1005, V1006, V1007. Resistors R1002 and R1003 are only used to start the converter.
- V1021/V1022 begin to conduct, starting the forward strike. The current path is through transformer winding 2-3, V1020, V1021, R1012//R1013, transformer winding 6-1. R1012//R1013 generate a voltage proportionel to the current.
- Transsformer winding 4-5 is used to supply positive feedback, via V1009, R1005 and R1006 to the darlington. This voltage provides fast saturation of V1020/V1021.
- Energy is loaded into and stored in the transformer.

5.8.1.2 End of the forward strike, start of the fly back strike.

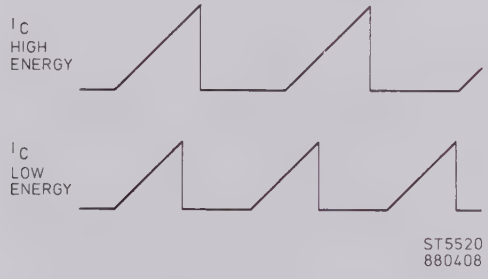
- The transformer winding 4-5 is identical to the secondary transformer winding. Its output voltage is sensed via R1009.
- A voltage proportional to the current flowing in the secondary load is produced across resistors R1012 and R1013. This voltage is sensed via R1008.
- The sum of the voltage sense (R1009) plus the current sense (R1008) is used to fire V1011 to control the output when:
  * Over voltage occurs (at no load), V1011 is fired via R1009.
  * Over current occurs (at high load), V1011 is fired via R1008.
  * Firing current temperature drift is compensated by NTC R1010. At higher temperature less firing current is required.
- When V1011 fires, V1009 stops conducting. Its emitter voltage drops from +7 V to 0 V. The base of V1020 is pulled negative via C1007 and V1016 .
- V1020/V1021 stops conducting, then the voltage at point 4 of transformer winding 4-5 becomes negative, fly back stroke started.
- During the fly back stroke energy is transferred into the secondary circuit.

5.8.1.3 End of fly back strike, start of next forward strike

- When all the energy is transferred, the voltage at point 4 of transformer winding 4-5 becomes more positive.
- This voltage rise is supplied to V1020 via C1006 and R1007 ==> V1020 starts conducting, etc.

5.8.1.4 Converter frequency

At higher loads, more energy has to be transferred. This is achieved by decreasing the frequency.

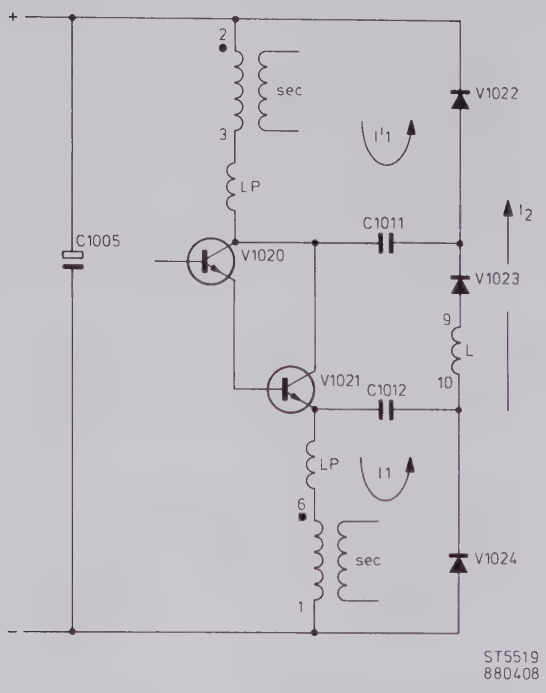


- When V1011 fires, C1009 is loaded (max. 0,7 V)
- V1014/V1013/R1011 behave like a zener diode (24 V)
- If point 4 of transformer winding 4-5 becomes less then about 25 V, C1009 will discharge.

  High load: zener voltage not reached, C1009 remains charged, firing point of V1011 delayed, lower frequency
  No load: zener voltage reached, C1009 unloaded, firing point of V1011 advanced, higher frequency
- C1008 is for interference suppression

5.8.1.5 Protection of V1020, V1021

At switch off V1020 and V1021 high voltage spikes would damage these transistors



- Not all the energy of the primary transformer windings is transferred to the secondary transformer winding due to parasitic inductances (Lp)
- Transistor V1021 switched off (fly back stroke) the energy in Lp is loaded into capacitors C1011 and C1012 (I1)
- During the forward strike (V1021 conducts) the energy of C1011 and C1012 is loaded into transformer winding L. This transformer winding is not coupled with the other transformer windings.
- During the next fly back stroke the energy of L is fed into the capacitors C1004 and C1005 via diodes V1024, V1023 and V1022.

5.8.1.6 Protection of the control circuit

If V1021 is defective (conducting continuously) R1012 and R1013 will be damaged (open). The voltage on the emitter of V1021 would rise to approx. 400 V and damage a lot more components if V1051 was not provided. Zener diode V1051 will draw the current and will be damaged; this will always result in a short circuit. As a result the primary fuse will blow.

5.8.1.7 EMC

R1015/C1013 and R1014/C1010 provide interference suppression to meet the Electro Magnetic Compatibility requirements.

5.8.2 SECONDARY CONVERTOR

The secondary converter converts the 24 V into the various supply voltages for the recorder. It operates on the same principle as the primary convertor.

5.8.2.1 Start-up/ forward strike

At start-up +24 V is supplied to the gate of power FET V1031. Result, V1031 starts conducting. The current through the primary transformer winding increases linear. The voltage at transformer point T1002:RED is positive and controls V1031 via C1019.

5.8.2.2 End forward strike/start fly back strike

The current through the primary transformer winding is sensed by R1020. When it is approx. 4 A (TP3 is 0,6 V) V1032 fires and the gate of FET V1032 becomes 0 V. The current is switched off and the voltage at transformer point T1002:RED becomes low. Via C1019 the gate of V1031 is made -0,7 V: the FET stops conducting. The energy stored in the transformer is transferred to the secondary circuit.

5.8.2.3 End fly back strike/start next forward strike

When the energy from the transformer is transferred, T1002:RED becomes positive and controls the gate of FET V1031: the FET conducts.

5.8.2.4 Output voltage regulation

The voltage of transformer winding T1002:RED-BROWN is rectified (V1034/V1035) and smoothed (C1020 etc.). The +5 V ouput is compared to the zener voltage of V1037 (5,1 V). The difference is integrated and controls the firing point of V1032.

NO LOAD: TP4 = +6 V ==> firing advanced, higher frequency
MAX. LOAD: TP4 = +1,5 V ==> firing point delayed, lower frequency
NOM.LOAD: TP4 = +5 V ==> freqeuncy approx. 80 kHz

R1024 is for temperature compensation of the firing point of V1032.

5.8.2.5 Supply sense

If TP4 > +1,5 V (supply voltage ready) 7N1001 is +5 V (external pull-up resistor on CPU).
If the +24 V supply drops, V1049 starts conducting and the SUPPLY SENSE signal goes low.

5.8.2.6 +5 V overvoltage protection

If the output voltage goes above 5 V (e.g. the +5 V regulation circuit is defective), V1036 will blow and cause a short circuit. In this way the circuitry connected to the +5 V will not be damaged.

5.8.2.7 Protection of V1031

C1017, C1021, V1029, V1030, L1005 and R1019 protect FET V1031 in a similar way as V1020 and V1021 in the primary converter are protected.

5.9 PAPER DETECTION P.C.B. A1100

Opto couplers are used in this unit to detect the beginning and the end of the paper. The ouput is a TTL signal.
In the future another opto coupler will be installed for counting the sprocket holes.
Different types of the GP2S02 (A, B, C) are used. This means, that when a replacment is necessary, you should check the type and eventually replace the serial resister, see table.

GP2S02	R1101	R1103	R1105	
A	953	953	953	ohm
B	681	681	681	ohm
C	442	442	442	ohm

5.10 PINCHWHEEL LIFT DETECTION P.C.B. A1200

The position of the pinch wheel is monitored by an opto coupler.
The output is a TTL signal.

5.11 REAR FLAP DETECTION P.C.B. A1300

The position of the rear flap is monitored by an opto coupler.
The output is a TTL signal

6. CHECKING AND ADJUSTING

The following information provides the complete checking and adjusting procedure for the instrument. As various control functions are interdependent, a certain order of adjustment is necessary.
The procedure is, therefore, presented in a sequence which is best suited to this order, cross-reference being made to any circuit which may affect a particular adjustment.
Before any check or adjustment, the instrument must attain its normal operating temperature.

- Warming-up time under average conditions is 60 minutes.
- Where possible, instrument performance should be checked before any adjustment is made.
- All limits and tolerances given in this Section are calibration guides, and should not be interpreted as instrument specifications unless they are also published in Section 2.
- Tolerances given are for the instrument under test and do not include test equipment error.
- All controls which are mentioned without item numbers are located on the outside of the instrument.

6.1 CHECKING

6.1.1 CPU free run mode

To check the microprocessor D102, the address latch D103 and the DATA and ADDRESS lines, the FREE RUN mode can be selected. In this mode the microprocessor reads the instruction 1111 1111 by disabling the ROM and forcing the data lines to a high level with pull up resistors. After executing the instruction ("move accumulator to register") the next address is selected and the same instruction is executed, etc.

Proceed as follows:

- Remove the input units
- Disconnect the flat cables from the DISPLAY/KEYBOARD P.C.B. and the SERVO UNIT
- Remove the ROM (D104)
- Set jumper 4 (X113) in the FREE RUN mode position
- Check the signals (see figure 6.1)

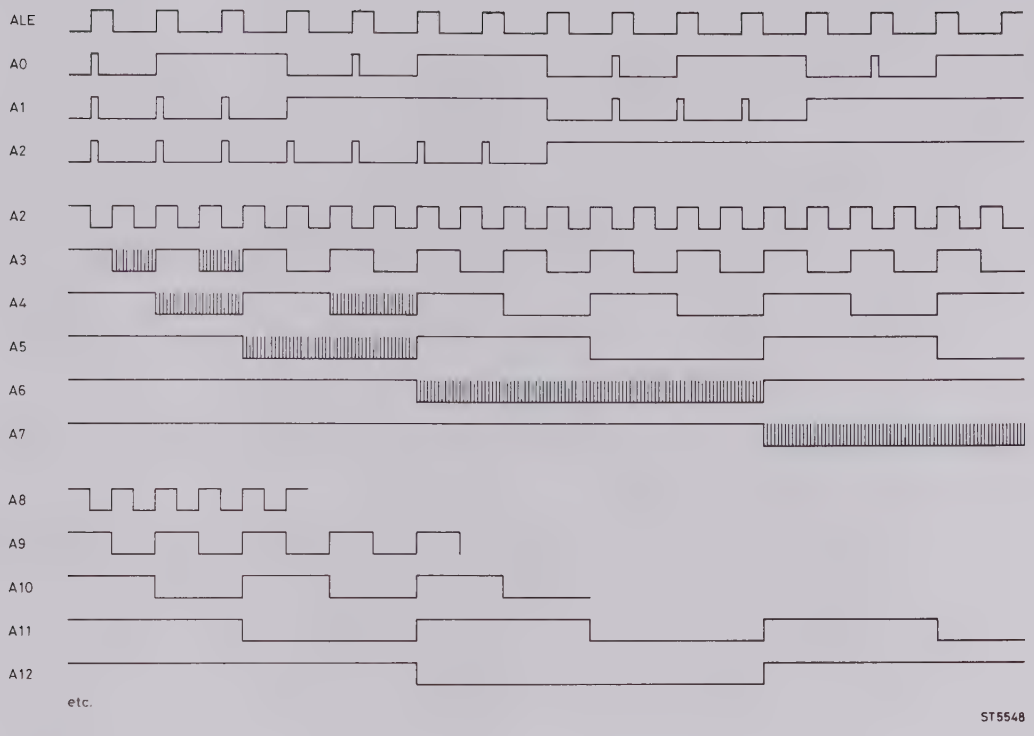


Figure 6.1

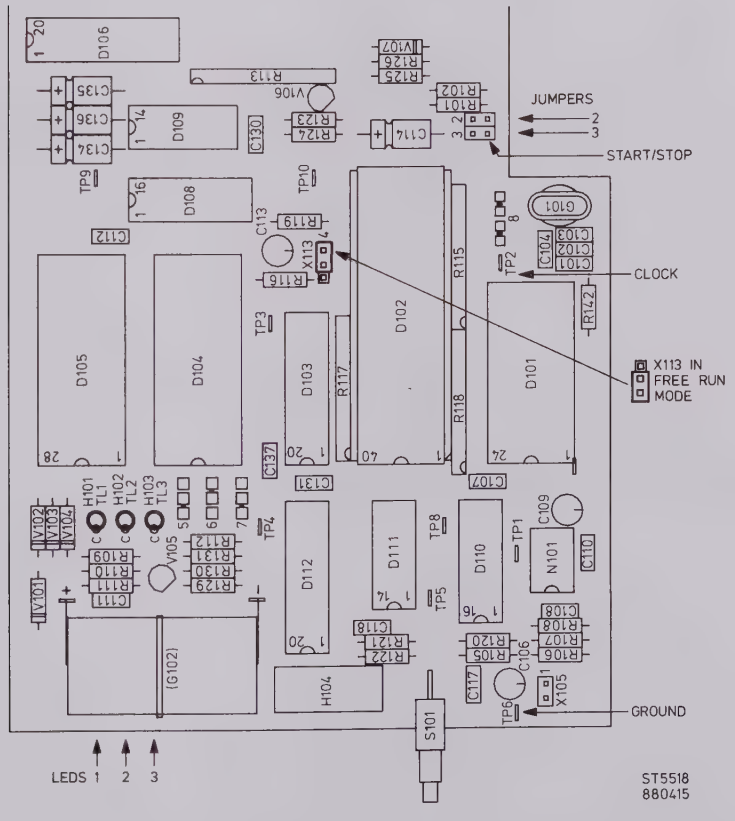


Figure 6.2

6.1.2 Tests programs

Two test programs are provided (see figure 6.2):

TEST 1: ADC - KEYBOARD/DISPLAY - WATCHDOG TEST
TEST 2: RAM - OUTPUT PORTS - DIGITAL SERVO IC TEST

TEST 1, ADC test

- remove jumpers 2 and 3 from the CPU board
- switch on the recorder

The displays will show:

CHART DISPLAY - ADC result (00000...16383, depending on the input signal)
CH.2 DISPLAY - the text "ADC" (only for the 2-line version)
CH.1 DISPLAY - the text "tESt"

If the MULTIRANGE P.C.B. is correct, the ADC reading must change when the input value changes and must be between 00000 and 16383.

If solder spot 2 on the ADC P.C.B. is opened, the ADC result should be approx. 8192.

TEST 1, KEYBOARD/DISPLAY TEST

- Remove jumpers 2 and 3 from the CPU board
- Remove the CHART CHANNEL input unit
- Switch on the recorder

DISPLAY

All display segments will be switched on sequentially.

KEYS

- Press one of the UP or DOWN keys to select the key-test
- Press a key

The display will show the number of the last key pressed. The keys are numbered, starting with 1 at the left upper corner, from left to right.

TEST 1, WATCHDOG TEST

- Remove jumpers 2 and 3 from the CPU board
- Disconnect the DISPLAY/KEYBOARD P.C.B. flat cable
- Switch on the recorder

If the WATCHDOG circuit on the CPU board functions correct:
- The beeper will beep periodically
- All three LEDs will be periodically switched on
- The pens will periodicallly be lifted and lowered

TEST 2, RAM TEST - OUPUT PORT TEST

- Remove jumper 3 from the CPU board
- Remove the input units
- Disconnect the DISPLAY/KEYBOARD P.C.B. flat cable
- Disconnect the SERVO UNIT flat cable
- Switch on the recorder

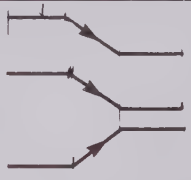
The test starts with a RAM check:

RAM defective ==> LED 1 "on" for 1 second and the beeper beeps 4 times

After this, signatures will be generated at various IC's:

D102 microprocessor port 1 and port 3
NOTE: port 0 and port 2 must be correct to run the test; these ports can be checked with the free run test.
D108 chip select circuit
D112 output port

To measure the signatures, connect the Signature Analyser as follows:

SIGNAL	S.A. SETTING	CONNECT TO
CLOCK		TP3 (ALE)
START		JUMPER 3, right hand pin
STOP		JUMPER 3, right hand pin
GROUND		TP6. USE THE GROUND CONNECTION ON THE PROBE OF THE SIGNATURE ANALYSER!!

The following signatures must be measured:

logic zero : 0000

D102 pin 1 : UP4F
2 : 9H39
3 : UP4F
4 : 9H39
5 : UP4F
6 : 9H39
7 : UP4F
8 : 9H39
10 : 03UA
11 : 608U
12 : 03UA
13 : 608U
15 : 608U
18 : 6375

logic 1 : 6375

D108 pin 1 : 4937
2 : 7UUA
3 : 2H57
6 : FAAP
12 : 6375
13 : 3PF8
14 : H8C4
15 : 4UA7

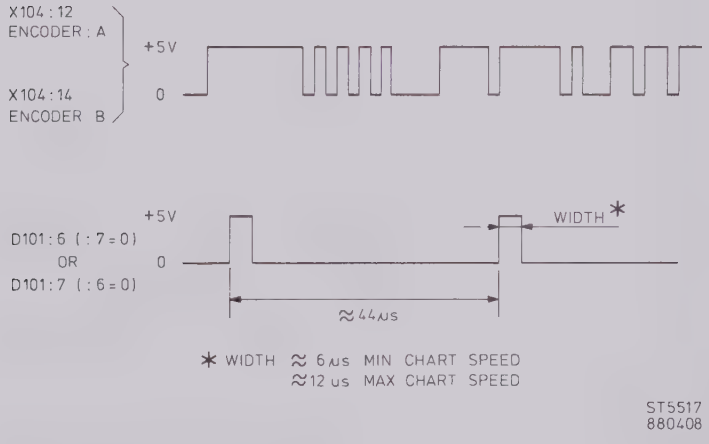
D112 pin 11 : 6375
12 : F3FA
13 : A253
14 : UF42
15 : 9H4P
16 : 9A9H
17 : 2H57
18 : 7UUH
19 : 4937

TEST 2, DIGITAL SERVO IC TEST (D101)

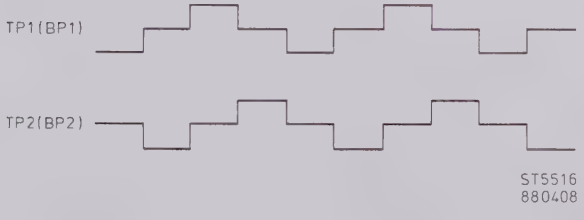
- Remove jumper 3 from the CPU board
- Remove the input units
- Disconnect the DISPLAY/KEYBOARD P.C.B. flat cable
- Disconnect the SERVO UNIT flat cable
- Interconnect on the CPU board
  5X104 with 3X106
  6X104 with 4X106
  12X104 with 9X106
  14X104 with 10X106
- Switch on the recorder

D101 correct ==> LED 1, 2 and 3 are "on"
D101 defective ==> LED 2 "on", LED 1 and 2 "off"

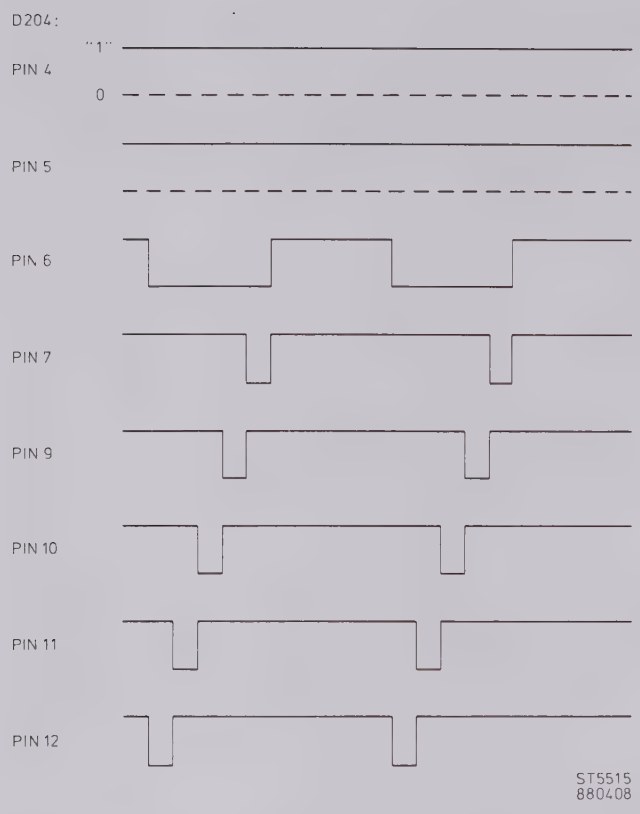
Signals at the test points in the TX mode.



6.1.3 Display/Keyboard P.C.B. A200



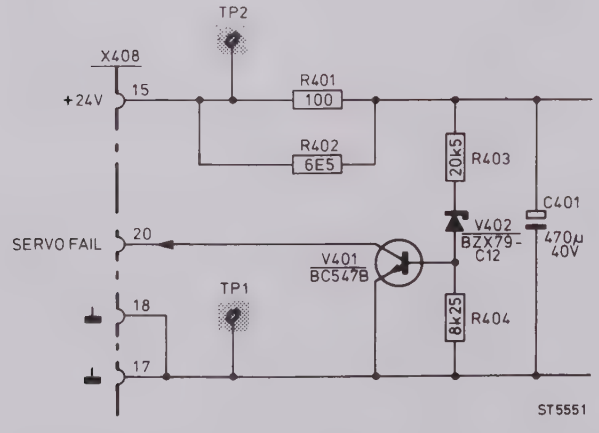
Solder spots 1, 2, 3, 4 and R204-R207 are for testing the I^2C lines.



When a key is pressed, the related line will go low "0".

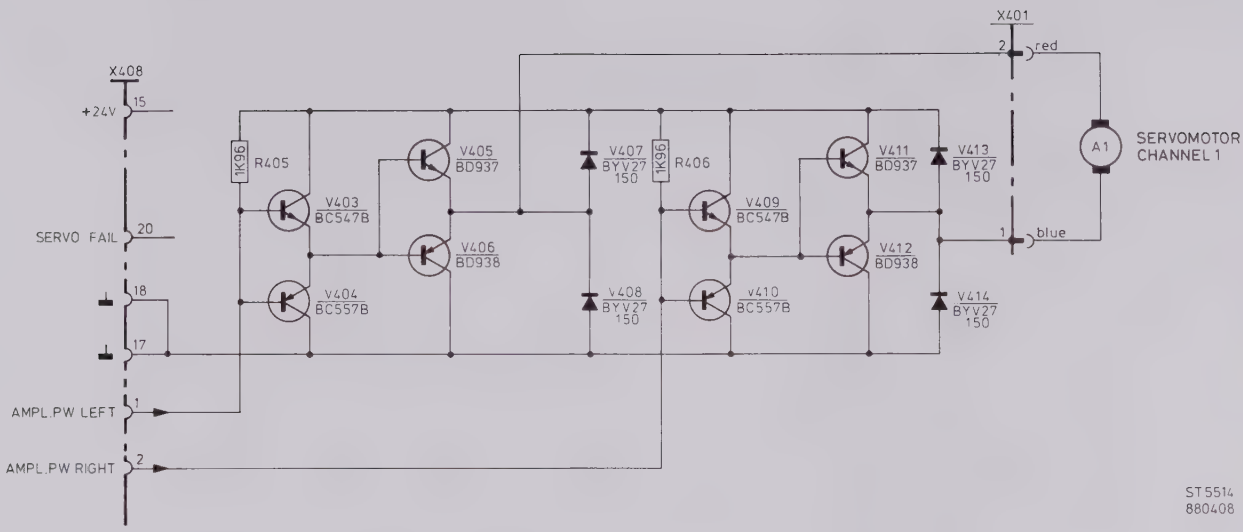
6.1.4 SERVO END STAGE P.C.B. A400

Overload protection



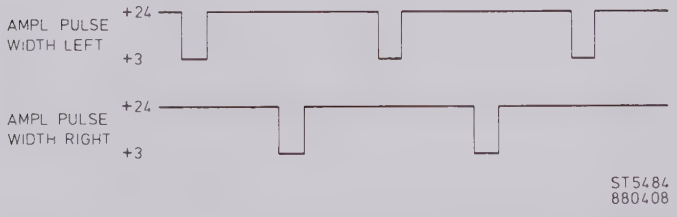
R422 is a PTC resister. The result of the PTC is a current limit. When V_C421 drops to approx 14 V, V421 will stop conducting ==> SERVO FAIL +5 V.

Amplifier part



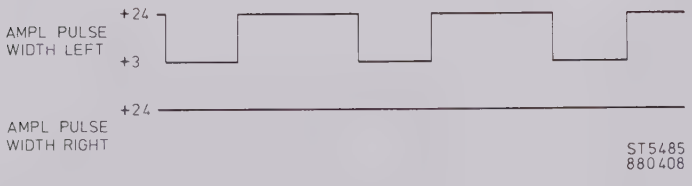
Signals X408 pin 1 and 2

In the balanced position:

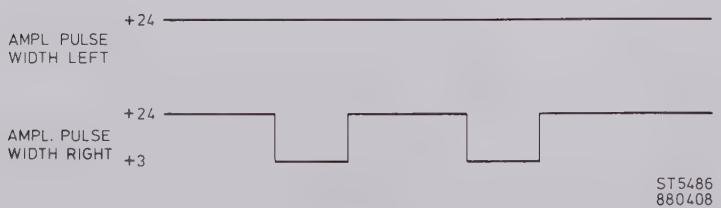


NOTE: In the balanced situation one or both of the above signals can be present.

Carriage moves to the left:



Carriage moves to the right:



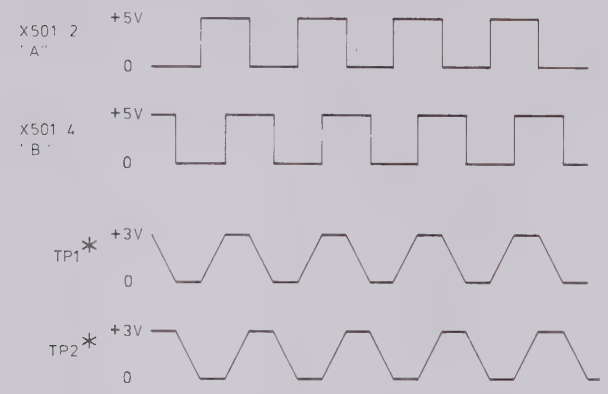
6.1.5 Encoder P.C.B. A500

Test points:

- Disassemble the drive unit and turn it upsite down.
- Disconnect the chart motor supply.
- Do not load paper. The LCD will show ErrPP.

TP1, TP2 and TP3 are solder spots on the conductor side.

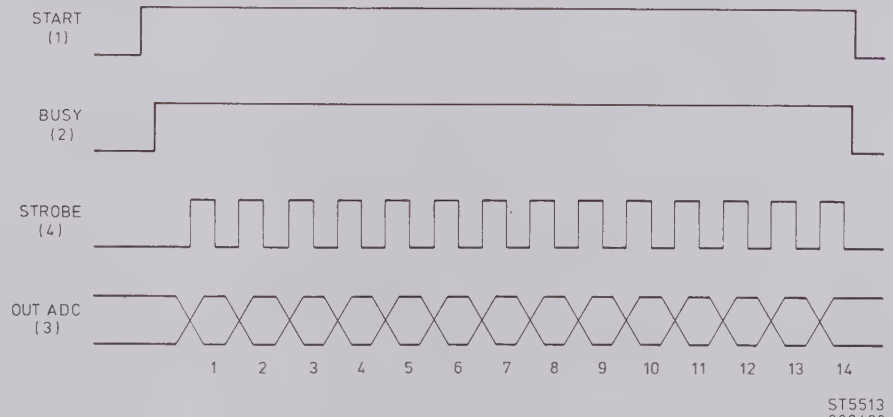
Move the motor by hand. Signals:



NOTE: TP1, TP2 and TP3 are solder spots on the conductor side.

6.1.6 ADC P.C.B. A600

Shift register in D605 (measurement)



12D603="1"
13D603=STROBE } 11D603=STROBE

6D602="1"
5D602="0" } 4D602="0" ==> 3D602="0"

1D602=STROBE

3D605=STROBE
5D605=ADC result } into shift register

4D602="0" ==> A601 disabled

End of the measurement

BUSY="0" ==> 11D603="0" ==> reset of D601 ==> 6D601="0"

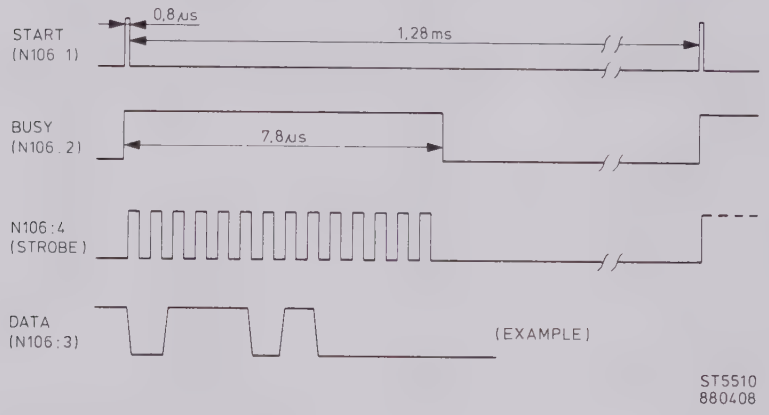
ADC data to the micro processor

Shift register out (D605)

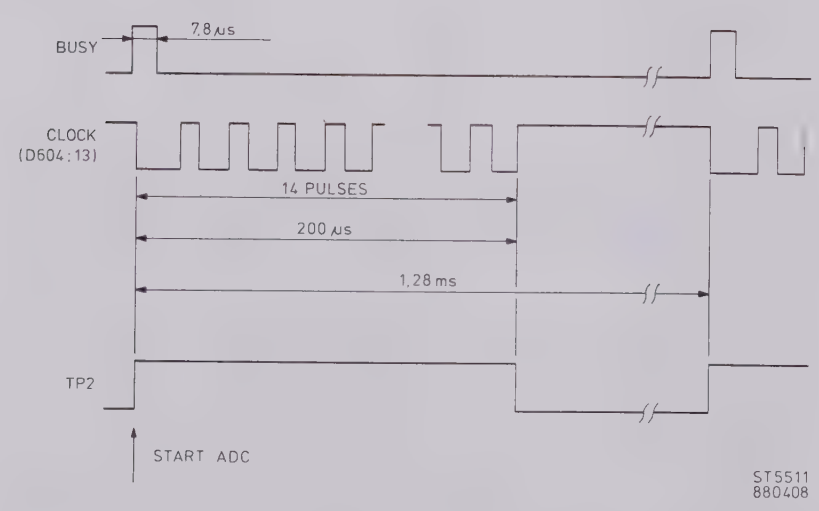
BUSY=0 A601= enabled
11D603= "0"
10D603= "1"
9D603 ==> 14 clock pulses
==> measure data (ADC result) via D604 to he micro processor

ADC signals:

Measure input signal



Read data from D605



6.1.7 Servo P.C.B. A700

Test points:

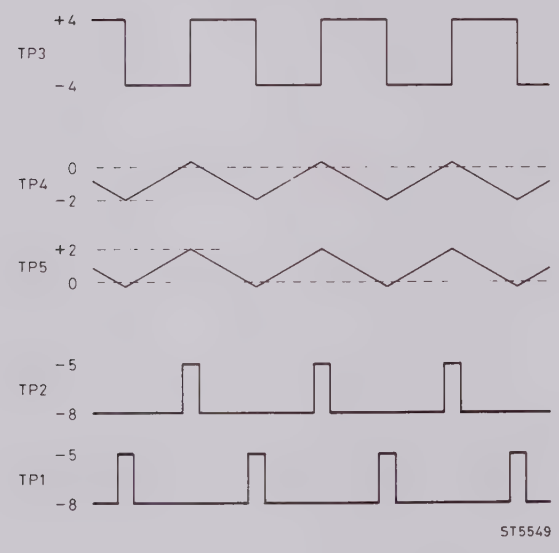
TP6 ==> -5 V...+5 V for 0...100% F.S.D. (Full Scale Deflection)

TP10 ==> +4,9 V...-4,9 V for 0...100% F.S.D.

TP11 ==> Balanced: between +0,1 and -0,1 V. During movement this voltage can be a square wave between +2 and -2 V.

TP7 ==> Balanced: 0 V
max. square wave between +300 and -300 mV.

TP8 ==> Balanced: 0 V
max. square wave between +0,75 and -0,75 mV.



TP1-TP5 drawn in the balanced position. If the carriage does not move, there will be no pulses at TP1 or TP2.

6.1.8 Multirange P.C.B. A800

Test points:

SPAN	Sensitivity	Voltage for 25 cm deflection	
mV	mV/cm	TP2 [mV]	K803-R806 [mV]
1	0,04	100	100
1,25	0,05	125	125
2	0,08	200	200
2,5	0,1	250	250
5	0,2	500	500
10	0,4	100	100
12,5	0,5	125	125
20	0,8	200	200
25	1	250	250
50	2	500	500
100	4	100	100
125	5	125	125
200	8	200	200
250	10	250	250
500	20	500	500
V	V/cm		
1	0,04	10	100
1,25	0,05	12,5	125
2	0,08	20	200
2,5	0,1	25	250
5	0,2	50	500
10	0,4	100	100
12,5	0,5	125	125
20	0,8	200	200
25	1	250	250
50	2	500	500

TP3 ==> 0,5 V for 25 cm deflection (min 0,25 V at uncal. span)
TP4 ==> 0,5 V for 25 cm deflection (min 0,25 V at uncal. span)
0...≃0,8 V at AXES for CH1 and CH2.

TP5 ==> at + span -0,5 V for 25 cm. HI=pos.(+)
LO=neg.(-)

at - span -0,5 V for 25 cm. HI=neg.(-)
LO=pos.(+)

TP6 ==> 0,5 V per 100% suppression

1X803 ==> -5...+ V for a deflection of: 25 cm in CH1 and CH2
38 cm in CHART CHANNEL

6X803 ==> -5...+ V for a deflection of: 25 cm in CH1 and CH2
38 cm in CHART CHANNEL

6.2 ADJUSTMENTS

6.2.1 Mechanical adjustments

6.2.1.1 Adjustment of the servo unit

Refer to section 3.4.2.

If the servo unit is not adjusted correctly, the angle between the X- and Y-axes on the chart will not be 90^{o}.

6.2.1.2 Adjustment of the chart drive belt tension

Refer to section 4.1.2 "Toothed belt (60T)".

The belt tension must be adjusted after the motor mounting plate has been loosened. If the tension is not correct, the chart speed or Y-axis deflection will be incorrect.

6.2.1.3 Adjustment of the servo belt tension

Refer to section 4.2.5.

The tension must be adjusted after the belt has been loosened. If the tension is not correct, the carriage will move irregularly or the servo system will vibrate.

6.2.1.4 Adjustment of the servo unit extrusions

Refer to section 4.2.3.

If the extrusions are not adjusted correctly, it will result in the following symptoms:

- The pens are not lifted sufficiently; at a positive fold of a fan fold book they will touch the paper.
- The angle between the X- and Y-axes on the chart is not 90^{o}.

6.2.1.5 Adjustment of the eccentric pin in the pinch wheel

Refer to section 4.1.2.

If the eccentric pin is not correctly adjusted, this will result in a bad reproducebility of the paper drive.

6.2.1.6 Adjustment of the friction between liftmotor and transmission

Refer to section 4.2.7.

If the friction is not correct, it will result in the bad functioning of the pen lift mechanism.

6.2.1.7 Adjustment of the bracket at P.C.B. A400

Refer to section 4.2.8.

The position must be adjusted after replacing the bracket or P.C.B. A400.

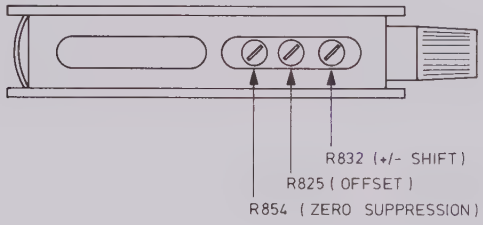
6.2.2 Electrical adjustments

FOLLOW THE ORDER AS GIVEN BELOW.

1- Multirange P.C.B.
2- Servo P.C.B. (CHANNEL 1 and 2) or ADC P.C.B. (CHART CHANNEL)

To adjust the boards, the right cover must be removed.
Before adjusting, the instrument must have been switched on with removed cover for at least 30 minutes.

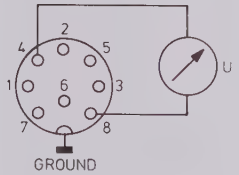
6.2.2.1 Multirange P.C.B. for CHANNEL 1 and CHANNEL 2



ST5324
870911

* OFFSET

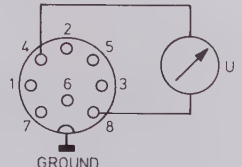
- Short circuit the HI and LO input
- Select the tX mode, REC on
- Measure the analog output voltage on the EXT connector pin 4 and pin 8 (ground)
- Select a calibrated span of 5 V
- Turn the -ZERO+ potentiometer on the keyboard until the analog output voltage is zero
- Select in turn a span of 10 V and 5 V
- Adjust R825 until the analog ouput voltage does not change when selecting another span. Also the pen should not move.



ST5317
870911

* +/- SHIFT

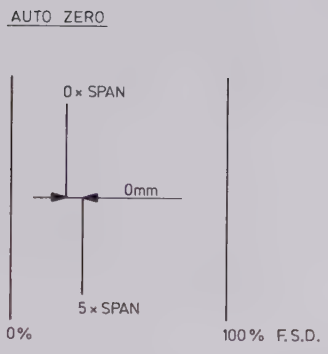
- Short circuit the HI and LO input
- Select the tX mode, REC on
- Measure the analog output voltage on the EXT connector pin 4 and pin 8 (ground)
- Select a calibrated span of 5 V
- Turn the -ZERO+ potentiometer at the keyboard until the analog output voltage is zero
- Select in turn a span polarity of + and - (+/- key)
- Adjust R832 until the analog ouput voltage does not change when selecting another polarity. Also the pen should not move.



ST5318
870911

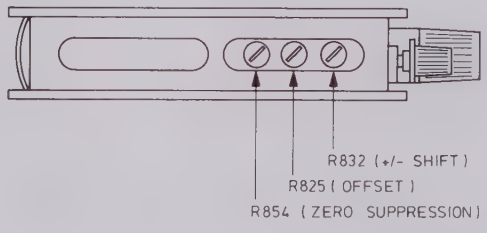
* ZERO SUPPRESSION

- Select the tX mode, REC on
- Select a calibrated span of 500 mV
- Select automatic zero suppression (AUTO)
- Apply a voltage of 0 V ±0,05 mV to the input, start the chart to record the pen position
- Apply a voltage of 2,5 V ±1 mV to the input, wait until the pen returns to the start position
- Adjust the pen deflection to the same value as for the 0 V input voltage with R854



ST5332
870911

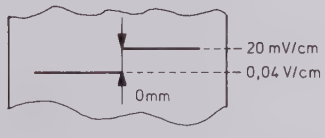
6.2.2.2 Multirange P.C.B. for the CHART CHANNEL



ST5325
870911

* OFFSET

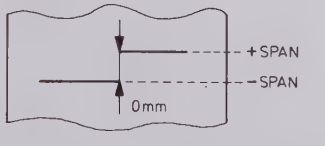
- Short circuit the HI and LO input terminal
- Select the XY mode, REC on
- Select in turn a calibrated span of 20 mV/cm and 0,04 V/cm
- Adjust R825 until the pen does not move when selecting another span



ST5329
870911

* +/- SHIFT

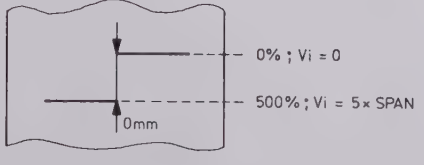
- Short circuit the HI and LO input terminal
- Select the XY mode, REC on
- Select a calibrated span of 20 mV/cm- select in turn a span polarity of + and - (+/- key)
- Adjust R832 until the paper does not move when selecting another polarity.



ST5330
870911

* ZERO SUPPRESSION

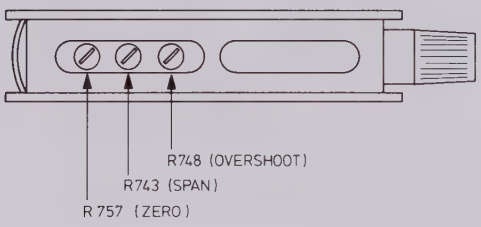
- Select the XY mode, REC on
- Select a calibrated span of 10 mV/cm
- Select a zero suppression of 0%
- Apply a voltage of 0 V ±0,05 mV to the input, turn the +ZERO- potentiometer of CH.1 or CH.2 to record the pen position



ST5331
870911

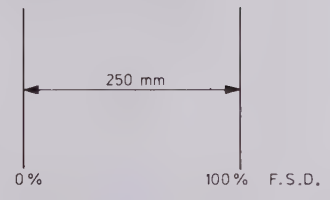
- Apply a voltage of 1,9 V ±1 mV to the input
- Select a zero suppression of 500%
- Adjust the paper position to the same value as for the 0 V input voltage with R854

6.2.2.3 Servo P.C.B. (CHANNEL 1 and 2 only)



ST5326
870911

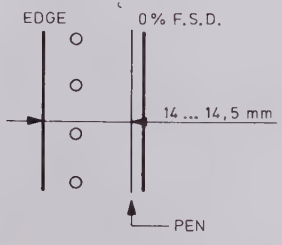
* SPAN



ST5320
870911

- Select the tX mode, REC on
- Select a calibrated span of 1 V
- Select 0% zero suppression
- Apply 0 V ±0,5 mV to the HI and LO
- Adjust the pen deflection to 0% of f.s.d. with the -ZERO+ potentiometer at the front
- Apply 1 V ±0,5 mV to the HI and LO
- Adjust the pen deflection to 250 mm with R743

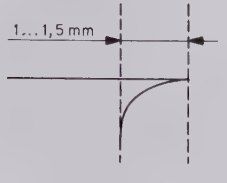
* ZERO



ST5321
870911

- Select the tX mode, REC on
- Short circuit the HI and LO input
- Select a calibrated span of 1 V
- Select a zero suppression of 150 % (display OL LO)
- Adjust the pen position to 14...14,5 mm from the left paper edge with R757

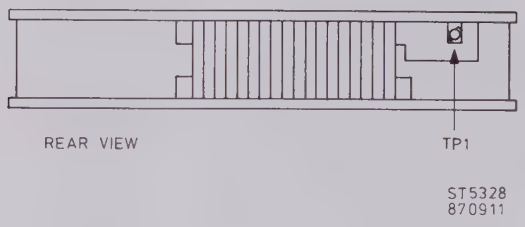
* OVERSHOOT

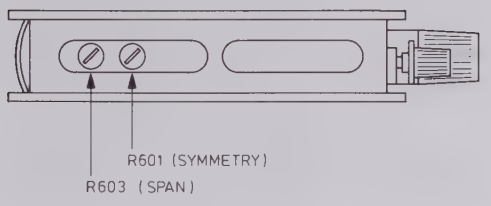


ST5322
870911

- Select the tX mode, REC on
- Apply a square wave with an amplitude of 50% of f.s.d. and with a maximum frequency of 0,5 Hz
- Adjust the overshoot to 1...1,5 mm with R748.

6.2.2.4 ADC P.C.B.





ST5327
870911

* SYMMETRY

- Measure the voltage between TP1 and the LO input terminal; adjust this value to zero with the ZERO potentiometer at the rear.
- Select the ADC test mode by removing jumpers 2 and 3 from the CPU P.C.B. The displays will show

XXXX	ADC	tESt
4-digit value	2-line only	

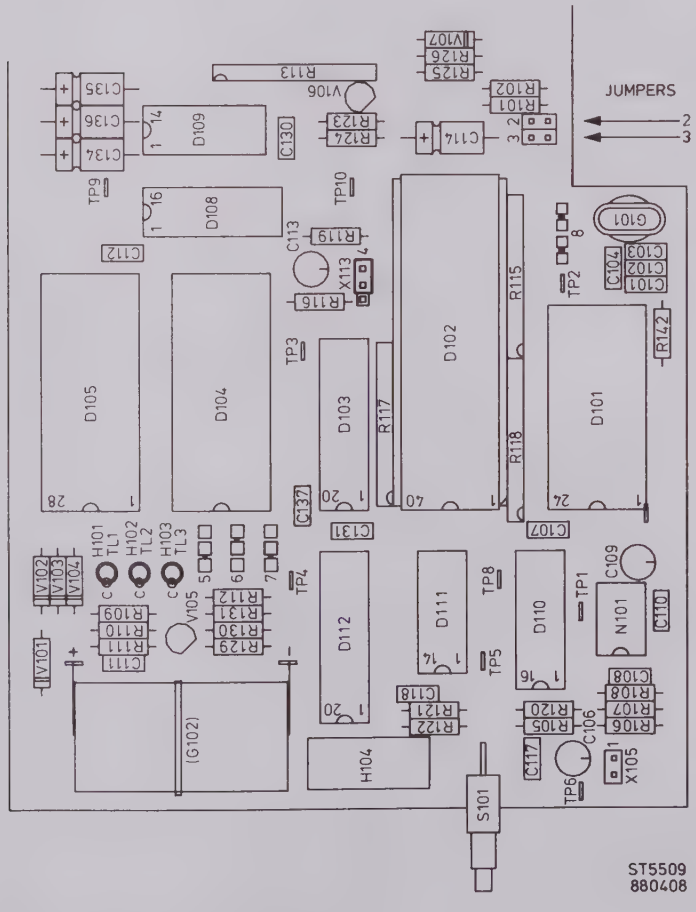
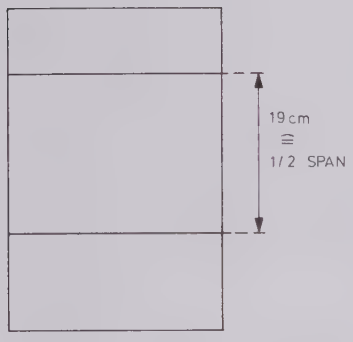


Figure 6.3 CPU P.C.B., ADC test mode selection

- Adjust the 4-digit value on the display to 8192 with R601
- Place jumpers 2 and 3 on the CPU P.C.B.

* SPAN

- Select the XY mode, REC on
- Set LENGTH=38 cm
- Select a calibrated sensitivity
- Apply a voltage of 19 x sensitivity
- Adjust the paper deflection with R605 to 190 mm; if this is not possible, open (if closed) or close (if open) solder spot SP601



ST5323
870911

6.2.2.5 Adjusting the encoder P.C.B.

Check of the voltages of MP1 and MP2.

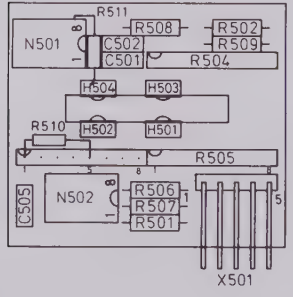
- Supply the motor with 5 Vdc.
- Measure MP1 and MP2. It should be 1,5 V < MP* < 3 V.

When these voltages sre not correct you should make the following adjustments:

A- P.C.B.'s with code no. 4022 321 7759.2.

* The voltage for TP1 can be adjusted with the mounting of R510.
* The voltage for TP2 can be adjusted with the mounting of R511.
* Adjust the voltage to: 2,3 V < MP* < 2,7 V.

ENCODER P.C.B. A500



ST5247
870706

Position of R510/511

After the resisters are cold again you should check TP again.
The level should be: 1,5 V < TP < 3 V

B- P.C.B.'s with code no. 4022 321 7759.3.

* It is not necessary to solder resisters to this P.C.B.. It has solder spots at the solder side. The sots "A" is at the edge of the P.C.B..
* The voltage should be: 2,3 V < TP < 2,7 V
* To adjust TP1 one or more of the spots A-D should be connected.
* To adjust TP2 one or more of the spots E-H should be connected.

Check phase output puls

Measure the output A and B with an oscilloscope.

- The amplitude must be 2,5 V $\pm$ 0,2 V.
- The phase difference must be between 60^0 and 120^0.

7. CORRECTIVE MAINTENANCE

7.1 REPLACEMENTS

7.1.1 Standard parts

Electrical and mechanical parts replacements can be obtained through your local Philips organisation or representative. However, many of the standard electronic components can be obtained from other local suppliers. Before purchasing or ordering replacement parts, check the parts list for value, tolerance, rating and description.

NOTE: Physical size and shape of a component may affect instruments performance, particularly at high frequencies. Always use direct-replacement components, unless it is known that a substitute will not degrade the instruments performance.

7.1.2 Special parts

In addition to the standard electronic components, some special components are used:

- Components, manufactured or selected by Philips to meet specific performance requirements.
- Components which are important for the safety of the instrument.

ATTENTION: Both type of components may only be replaced by components obtained through your local Philips organisation or representative.
These components have been marked in the Parts List by a *.

7.2 FAULTFINDING

7.2.1 Faultfinding the power supply

1- Remove X1003;
2- Eventually replace fuse F1
3- Switch on the power. When the primary power supply is correct H1003 will be on and the output voltage should be 28 Vdc approx.

7.2.1.1 Primary circuit

- Place jumper X1004. It shortcircuits the base and the emitter. Now the current of V1020/V1021 should be zero. The current via V1009 is 2 mA approx.

If the current is not appox. zero, then:

- Remove the recorder from the mains.
- Check V1051, R1012, R1013, V1022, V1013, C1010, C1011 and V1024.
- Replace V1020, V1021.
- Apply 24 V via a resitor of 500 ohm, see item 1 in figure 7.1.
- Check the voltages in the diagram.
- Remove the voltage before starting the next check.
- Apply 35 V via a resistor of 500 ohm, see item 2 in figure 7.1.

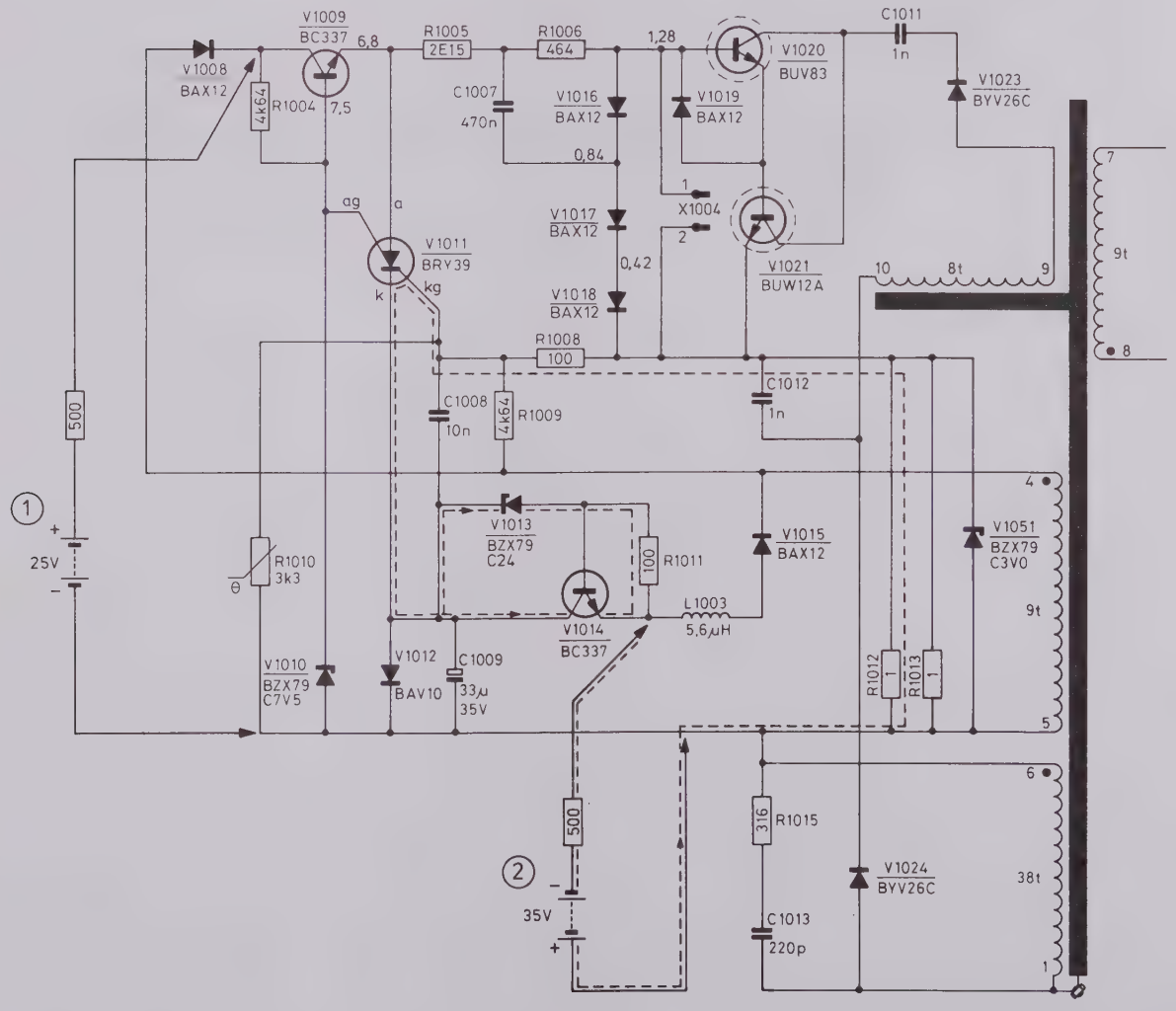


Figure 7.1

ST5507
880408

The dashed line gives the current path. Now it is possible to check:

1- Base emitter voltage k/kg.
2- Zener voltage of V1013
3- Vce of V1014. It should be 25 V approx.

7.2.1.2 Secondary circuit

It is posible to use the primary power supply or to use 24 Vdc via the external 24 V connector (eventually via TP1(+) and TP6(-)).

1- Check V1036 and replace it when defective. This zener diode will short the 5 V to zero when has been blown up by a high voltage.
2- Connect TP2 to ground (⊥).
   After this V1031 must not be conducting (TP3=0 V). The total supply current is 15 mA approx.
   - If it is not correct replace V1031 and V1032.
   - If it is correct, continue at 3.
3- Apply +5 V to the +5 V supply output (TP5).
   Vary the applied voltage between 4,8 and 5,2 V ==> the voltage at TP4 must change from high to low, if not check TP7 (5,1 V) or replace N1001.

Test N1001

Connect TP7 to 0: H1001 on (brightly)
H1002 off
Output 0

7.2.1.3 Voltages at nominal load

TP1 = +24 V
TP4 = +5 V (varies slightly when load changes)
TP5 = +5 V
TP6 = ground
TP7 = +5,1 V (reference)

7.2.2 Faultfinding the servo system

Fault: no action at all.

* Check the different voltages of the power supply A1000, see section 7.2.1.3.
* Check the CPU P.C.B. see section 6.1.2.
* Check the functioning of the keyboard/display P.C.B., see section 6.1.3.
* Check the servo system.
  - Check the supply voltages ± 8 V_{AN} and ± 5 V.
  - Select the 1 V range.
  - Put 0,5 V at the input.
  - Check the positions of K802, K803 and D801. You can replace the switches by connecting the solder spots.

Switching from zero to record will result in a voltage change at the following points.

- TP2 100 mV
- TP3 500 mV
- TP4 500 mV
- TP5 -500 mV zero +
  +500 mV zero -
- TP6 250 mV for every 50% suppression

==> A800

- TP6 ±5 V ==> A700

Disconnect the servo motor. Move the carriage by hand from one side to the other side.

- TP10 voltage ± 5 V
- TP8 output limits of the IC
- Check TP4 and TP5
- Check TP1 and TP2

==> Puls drawn in the diagram

P.C.B. A400

- Check TP2-TP1 ==> 24 Vdc
- Check the pulses at the base of V403/V404 and V409/V410 see section 6.1.4.

7.2.3 Faultfinding the chart drive circuit

- Check the pulses: A pin 2X501
  B pin 4X501

  see section 6.1.5.
- Check the functioning/signals of the digital servo IC D101 see section 6.1.2.
- Check the pulses at X104 pin 5 and 6.
- Check the chart channel servo amplifier P.C.B. A400

7.2.4 Fault finding servo system chart channel

- Check the chart drive circuit, see section 6.1.5.
- Check the multirange P.C.B. of the chart channel, see check servo system
- Check ADC P.C.B., see section 6.1.6.

8. SAFETY INSPECTION TESTS AFTER REPAIR AND MAINTENANCE IN THE PRIMARY CIRCUIT

8.1 GENERAL DIRECTIVES

- Take care that the creepage distance and clearances have not been reduced.
- Before soldering, the wires should be bent through the holes of solder tags, or wrapped around the tag in the from of an open U, or, wiring ridigity shall be maintained by cable clamps or cable lacing.
- Replace all insulating guards and plates.

8.2 SAFETY COMPONENTS

Components in the primary circuit may only be renewed by components selected by Philips, see also 7.1.2.

8.3 CHECKING THE PROTECTIVE EARTH CONNECTION

The correct connection and condition is checked by visual control and by measuring the resistance between the protective lead connection at the plug and the cabinet/frame. The resistance shall not be more than 0.5 ohm. During measurement the mains cable should be removed. Resistance variations indicate a defect.

8.4 CHECKING THE INSULATION RESISTANCE

Measure the insulation resistance at U = 500 V dc between the mains connections and the protective lead connections. For this purpose set the mains switch to ON. The insulation resistance shall not be less than 2 Mohms.

NOTE: 2 Mohms is a minimum requirement at 40 $_{o}$C and 95% Relative Humidity. Under normal conditions the insulation resistance should be much higher (10...20 Mohms).

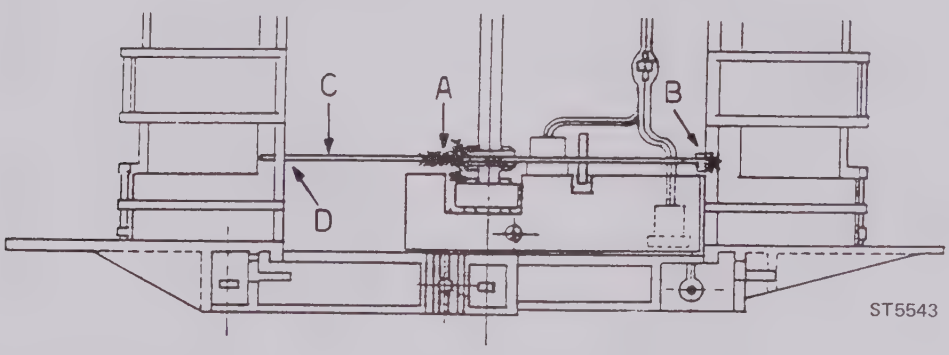
8.5 CHECKING THE MAINS CONNECTIONS TO THE POWER SUPPLY P.C.B.

When connections FP1, FP2 and FP3 of P.C.B. A1000 have been disconnected from the P.C.B., you should visualy check it is re-connected correctly.

9. MODIFICATIONS

1- To improve the reproducibility of the registration due to the paper movement, the pin in the pinch wheel in the left paper guide is replaced by an eccentric pin. In the later versions both pinch wheels have an eccentric pin. This modification can be done in the older recorders. For the adjustment see 4.1.2.

2- In some recorders an eccentric pin is used in the pinch wheel with a bigger diameter. If you have to replace this eccentric pin, you must replace the paperguide and the eccentric pin.



3- The assembling of the shaft retaining bar and the retaining bar at the right side have been modified. The fixing for the retaining bar was no good because the cams broke. Solution:

a- Remove the cams at A.
b- Press the new retaining bar at the bearing and at the edge B.
c- Heat the retaining bar at C and press it through the plastic at D.
d- When the material is cold again you can fix the bar at B in the normal way.

4- Switch S101 will be left off the ADC P.C.B.

5- The servo motors and the chart drive motor must be mounted with washers (2,7x8x0,8) between the screws and the housing/mounting plate. If an incorrect washer is used, the screw can hit the motor windings. The result is hum and unstability.

6- Under the pen lift motor, shims have been placed to adjust the friction between motor and lift mechanism (see section 4.2.7.).

7- In the single line recorder the guide profile for the second line is also present. This is to prevent the lift profile jumps from jumping out of the measuring carriage.

8- The wires of the chart motor are led through a toroïd (3 turns). Service no. toroïd 5322 526 14029. Reason: During chart transport you can see a movement of the servo system when the brushes of the chart motor are going from one commutator blade to the other.

9- To prevent that the drive belt on the chart motor from running the pulley, a bracket has been mounted. The older versions can easily be modified.

10- The secunary power supply will be modified. In the future it will have two extra -24 Vdc outputs for use in other type numbers.

10. PARTS LIST

10.1 PRINTED CIRCUITS BOARDS

ITEM	DESCRIPTION	SERV. NO.
A0100	C.P.U. (1-line)	5322 216 93843
A0100	C.P.U. (2-line)	5322 216 93835
A0200	DISPLAY/KEYBOARD (1-line)	5322 216 93837
A0200	DISPLAY/KEYBOARD (2-line)	5322 216 93834
A0400	SERVO END STAGE (1-line)	5322 216 93838
A0400	SERVO END STAGE (2-line)	5322 216 93831
A0500	ENCODER	5322 216 93833
A0600	ADC	5322 216 93924
A0700	SERVO	5322 216 93829
A0800	MULTIRANGE	5322 216 93828
A1000	POWER SUPPLY	5322 216 93832
A1100	PAPER DETECTION	5322 216 93841
A1200	PINCH WHEEL LIFT DETECTION	5322 216 93839
A1300	REAR FLAP DETECTION	5322 216 93842

10.2 MECHANICAL PARTS

1 FIG. 4.10	SHAFT + DRIVE WHEELS	5322 535 92333
2 FIG. 4.10	RETAINING BAR FOR SHAFT	5322 492 63713
4 FIG. 4.10	RETAINING BAR FOR SHAFT (LONG)	5322 492 69925
3 FIG. 4.10	SPRING CONTACT FOR SHAFT	5322 492 63715
2 FIG. 10.2	PINCH WHEEL	5322 528 81167
3 FIG. 10.2	PINCH WHEEL PIN	5322 520 40228
3 FIG. 10.2	PINCH WHEEL ECCENTER PIN	5322 535 92461
4 FIG. 10.2	DARK PLATE IN LEFT PAPER GUIDE	5322 466 30268
5 Fig. 10.2	PAPER GUIDE RIGHT	5322 466 30266
1 FIG. 1.2	PAPER GUIDE LEFT	5322 466 30265
3 FIG. 10.1 6 FIG. 10.2	FLAG (LOAD/OPERATE DETECTION)	5322 466 30267
1 FIG. 10.1	SPRING BETWEEN PAPER GUIDES	5322 492 32721
	BELT PULLEY (CARRIAGE)	5322 528 90646
	TOOTHED BELT 60T (CHART)	5322 358 30764
	TOOTHED BELT 347T 2-line	5322 358 30765
	TOOTHETD BELT 400T	5322 358 30766
	CARRIAGE (INCL. PEN HOLDER AND CONTACTS)	5322 256 91197
2 FIG. 10.1	PEN LIFT TRANSMISSION	5322 522 10391
4 FIG. 10.1	SPRING FOR TOP COVER	5322 492 63714
	KNOB (LOAD/OPERATE)	5322 414 60057
	PUSH BUTTON 6,5 x 6,5	5322 414 20031

ITEM	DESCRIPTION	SERV. NO.
	PUSH BUTTON XYNT	5322 414 60146
	FRONT FLAP	5322 466 30263
	REAR FLAP	5322 466 30264
	CONTACT OIL 1 CC	5322 390 14001
	SHEET GUIDE BRACKET	5322 492 63712

10.3 MOTORS

A0001	SERVO MOTOR	5322 361 41013
A0002	SERVO MOTOR	5322 361 41013
A0004	PEN LIFT MOTOR	5322 361 41014
A0005	PEN LIFT MOTOR	5322 361 41014
	ENCODER + CHART MOTOR (without PCB A500)	5322 361 10456

10.4 CABLES AND CONNECTORS

	FLAT CABLE X1001-X110	5322 321 22355
	FLAT CABLE X408-X104	5322 321 22356
	FLAT CABLE X102-X201	5322 321 22354
	MAINS CABLE	5322 321 10388
	24 VDC CABLE	5322 321 22353
	8-POLE DIN PLUG (CABLE PART)	5322 264 50121
	HOUSING POTMETER CONNECTOR	5322 268 40279
	INPUT TERMINAL "HI"	5322 267 34057
	INPUT TERMINAL "LO"	5322 267 30527
	EARTH TERMINAL	5322 267 34058
	ISOLATION RING	5322 267 30528
	ISOLATION RING	5322 532 64081
	AMP FASTON PEN (MAINS CONNECTION"	5322 268 14031
	CON. HOUSING (SERVO MOTOR)	5322 268 40232
	BUS CONTACT CRIMP (SERVO MOTOR)	5322 268 20152
X0001	MAINS FILTER/CONNECTOR	5322 219 80978
X0002	CONNECTOR 12/24 VDC	5322 265 30527
X0102	P STRAIGHT	5322 265 40643
X0103	P STRAIGHT	5322 265 51186
X0105	STRAIGHT OPEN	5322 265 20283
X0106	8-P	5322 267 50663
X0107	8-P	5322 267 50663
X0108	8-P	5322 267 50663
X0109	STRAIGHT OPEN	5322 265 20283
X0110	P STRAIGHT	5322 265 51185
X0111	P STRAIGHT	5322 265 40642
X0112	STRAIGHT OPEN	5322 265 20283
X0113	STRAIGHT UNSHR.	5322 265 30532
X0401	2-P STRAIGHT	5322 265 20275
X0402	2-P STRAIGHT	5322 265 20275
X0403	2-P STRAIGHT	5322 265 20275
X0404	2-P STRAIGHT	5322 265 20275
X0405	2-P STRAIGHT	5322 265 20275

ITEM	DESCRIPTION	SERV. NO.
X0406	16-P STRAIGHT	5322 265 61117
X0407	5-P STRAIGHT	5322 265 30531
X0409	2-P STRAIGHT	5322 265 20275
X0501	90° OPEN	5322 265 30528
X0601	P 90° OPEN	5322 265 40644
X0602	8-P 90°	5322 267 54107
X0701	P 90° OPEN	5322 265 40644
X0702	8-P 90°	5322 267 54107
X0704	5-P	5322 265 30529
X0803	18-P	5322 290 60671
X1001	20-P DBL STRAIGHT	5322 265 51129
X1002	2-P STRAIGHT	5322 265 20275
X1003	STRAIGHT OPEN	5322 265 20283
X1003	MOLEX 90120-1082	5322 265 20283
X1004	90°	5322 265 20356
X1101	3-P STRAIGHT	5322 265 30433
X1201	3-P STRAIGHT	5322 265 30433
X1301	3-P STRAIGHT	5322 265 30433

10.5 PARTS GENERAL

	TRANSP. LCD HOUSING	5322 381 10887
	CONNECTION RUBBER LCD	5322 267 70213
	JUMPER FEM.2-P	5322 263 60062
	CLIP FOR V1020-V1021	5322 255 40397
A0006	MEASURING POT. METER	5322 691 20417
A0007	MEASURING POT. METER	5322 691 20417
F0001	FUSE T5x20 1,6 A	4822 253 30024
F0002	FUSE F5x20 2,5 A	4822 253 20024
	FUSE HOLDER(AC AND DC)	5322 256 30242

10.6 SERVICE TOOLS

EXTENSION CABLE 16-P, to be used for: 5322 321 22548

- Connection of the CPU-board and input unit
  (if the input unit has to be measured)
- Connection of the servo unit X406
  (on SERVO END STAGE board)
  and cable loom if servo unit is removed.

EXTENSION CABLE 5-P, to be used for: 5322 321 22549

- Connection of measuring potentiometer and input unit
  (if input unit has to be measured)
- Connection of the servo unit X407 (on SERVO END STAGE board)
  and cable loom if servo unit is removed.

Mounting block for the extrusion profiles 5322 466 61679

ITEM	DESCRIPTION			SERV. NO.
10.7	CAPACITORS			
C 0101	-20+50%	10NF		4822 122 31414
C 0102	2%	33P		5322 122 32072
C 0103	2%	33P		5322 122 32072
C 0104	2%	18P		4822 122 31061
C 0105	-20+50%	10NF		4822 122 31414
C 0106	-20+20%	10UF		5322 124 21731
C 0107	-20+50%	10NF		4822 122 31414
C 0108	-20+50%	10NF		4822 122 31414
C 0109	-20+20%	10UF		5322 124 21731
C 0110	63V 10%	100NF		5322 121 42386
C 0111	-20+50%	10NF		4822 122 31414
C 0112	-20+50%	10NF		4822 122 31414
C 0113	-20+20%	10UF		5322 124 21731
C 0115	-20+20%	330UF		5322 124 22095
C 0116	-20+20%	2200UF		4822 124 21324
C 0117	63V 10%	100NF		5322 121 42386
C 0118	10%	4.7NF		4822 122 31125
C 0119	-20+20%	68UF		5322 124 41384
C 0120	-20+20%	68UF		5322 124 41384
C 0121	-20+50%	10NF		4822 122 31414
C 0122	-20+20%	330UF		5322 124 22095
C 0123	-20+20%	330UF		5322 124 22095
C 0124	-20+20%	68UF		5322 124 41384
C 0125	-20+20%	68UF		5322 124 41384
C 0126	-20+50%	10NF		4822 122 31414
C 0127	-20+50%	10NF		4822 122 31414
C 0128	-20+50%	10NF		4822 122 31414
C 0129	-20+50%	10NF		4822 122 31414
C 0132	-20+50%	10NF		4822 122 31414
C 0133	-20+50%	10NF		4822 122 31414
C 0134	-10+50%	15UF		4822 124 20709
C 0135	-10+50%	15UF		4822 124 20709
C 0136	-10+50%	15UF		4822 124 20709
C 0137	-20+50%	10NF		4822 122 31414
C 0138	10NF		100V	4822 122 31414
C 0139	10NF		100V	4822 122 31414
C 0140	10NF		100V	4822 122 31414
C 0141	10NF		100V	4822 122 31414
C 0142	10NF		100V	4822 122 31414
C 0143	180PF	2%	100V	5322 122 31907
C 0201	10%	820PF		4822 122 30135
C 0202	-10+50%	33UF		4822 124 20712
C 0203	100V 10%	10NF		4822 121 41857
C 0401	-20+20%	470UF		5322 124 21729
C 0421	-20+20%	470UF		5322 124 21729
C 0441	-20+20%	470UF		5322 124 21729
C 0501	63V 10%	4.7NF		5322 121 43018
C 0502	63V 10%	4.7NF		5322 121 43018
C 0503	100V 10%	10NF		4822 121 41857
C 0504	100V 10%	10NF		4822 121 41857
C 0505	63V 10%	100NF		5322 121 42386
C 0601	10%	820PF		4822 122 30135
C 0602	63V 10%	100NF		5322 121 42386
C 0603	63V 10%	100NF		5322 121 42386
C 0604	63V 10%	100NF		5322 121 42386
C 0605	2%	220PF		5322 122 32346
C 0606	63V 10%	470NF		5322 121 42467
C 0607	63V 10%	470NF		5322 121 42467
C 0608	63V 10%	470NF		5322 121 42467
C 0609	63V 10%	470NF		5322 121 42467
C 0610	63V 10%	470NF		5322 121 42467

ITEM	DESCRIPTION	SERV. NO.
C 0611	63V 10% 470NF	5322 121 42467
C 0612	63V 10% 470NF	5322 121 42467
C 0613	63V 10% 470NF	5322 121 42467
C 0614	63V 10% 470NF	5322 121 42467
C 0615	63V 10% 470NF	5322 121 42467
C 0616	10% 3.3NF	4822 122 30099
C 0617	-10+50% 22UF	4822 124 20698
C 0618	-10+50% 33UF	4822 124 20688
C 0619	-10+50% 22UF	4822 124 20698
C 0620	-10+50% 33UF	4822 124 20688
C 0621	-10+50% 22UF	4822 124 20698
C 0622	-10+50% 33UF	4822 124 20712
C 0623	100V 2% 27PF	4822 122 30045
C 0624	50V 10% 22NF	5322 122 10356
C 0625	-20+80% 22NF	4822 122 30103
C 0626	-20+80% 22NF	4822 122 30103
C 0627	63V 10% 100NF	5322 121 42386
C 0628	63V 10% 100NF	5322 121 42386
C 0629	-20+80% 22NF	4822 122 30103
C 0630	-20+80% 22NF	4822 122 30103
C 0631	-20+80% 22NF	4822 122 30103
C 0632	-20+20% 68UF	5322 124 41384
C 0633	22NF 10% 50V	5322 122 10356
C 0701	-20+80% 22NF	4822 122 30103
C 0702	-20+80% 22NF	4822 122 30103
C 0704	-20+80% 22NF	4822 122 30103
C 0705	100V 10% 10NF	4822 121 41857
C 0706	63V 10% 330NF	5322 121 42661
C 0707	100V 10% 33NF	5322 121 42489
C 0708	100V 10% 22NF	4822 121 41856
C 0709	-20+50% 10NF	4822 122 31414
C 0710	100V 10% 22NF	4822 121 41856
C 0711	-20+50% 10NF	4822 122 31414
C 0712	100V 10% 22NF	4822 121 41856
C 0713	-20+20% 22UF	5322 124 41381
C 0714	-20+20% 2.2UF	5322 124 41379
C 0715	63V 1% 3.6NF	4822 121 50088
C 0716	-20+20% 22UF	5322 124 41381
C 0717	-20+20% 68UF	5322 124 41384
C 0718	-20+20% 68UF	5322 124 41384
C 0719	63V 10% 100NF	5322 121 42386
C 0720	63V 10% 100NF	5322 121 42386
C 0721	100NF 5% 63V	5322 121 42386
C 0722	10NF 100V	4822 122 31414
C 0723	10NF 100V	4822 122 31414
C 0724	22NF 10% 50V	5322 122 10356
C 0801	-20+80% 22NF	4822 122 30103
C 0802	63V 10% 1UF	5322 121 42114
C 0803	10% 1NF	4822 122 30027
C 0804	63V 10% 100NF	5322 121 42386
C 0805	63V 10% 220NF	4822 121 41855
C 0806	100V 10% 15NF	5322 121 42975
C 0807	63V 10% 100NF	5322 121 42386
C 0808	63V 10% 100NF	5322 121 42386
C 0809	-20+20% 68UF	5322 124 41384
C 0810	-20+20% 68UF	5322 124 41384
C 0812	63V 10% 470NF	5322 121 42467
C 0813	2% 100PF	4822 122 31316
C 0814	10% 1NF	4822 122 30027
C 0815	63V 10% 100NF	5322 121 42386
C 0816	63V 10% 47NF	5322 121 42604
C 0817	-20+20% 68UF	5322 124 41384
C 0818	-20+20% 68UF	5322 124 41384
C 0819	10% 470PF	4822 122 30034
C 0820	-20+50% 10NF	4822 122 31414

ITEM	DESCRIPTION	SERV. NO.
C 0821	2% 100PF	4822 122 31316
C 0822	-20+50% 10NF	4822 122 31414
C 0823	63V 10% 100NF	5322 121 42386
C 0824	-20+50% 10NF	4822 122 31414
C 0825	-20+50% 10NF	4822 122 31414
C 0826	10% 1NF	4822 122 30027
C 0827	100V 10% 22NF	4822 121 41856
C 0828	63V 10% 100NF	5322 121 42386
C 0829	-20+20% 4.7UF	5322 124 41382
C 0830	2% 100PF	4822 122 31316
C 1001	250V 20% 220NF	5322 121 44372
C 1002	20% 400V 1NF	5322 122 40364
C 1003	20% 400V 1NF	5322 122 40364
C 1004	-20+20% 68UF	5322 124 21938
C 1005	-20+20% 68UF	5322 124 21938
C 1006	-20+50% 10NF	4822 122 31414
C 1007	63V 10% 470NF	5322 121 42467
C 1008	-20+50% 10NF	4822 122 31414
C 1009	-20+20% 33UF	5322 124 41378
C 1010	630V 1% 220PF	5322 121 54059
C 1011	250V 5% 1NF	4822 121 50566
C 1012	250V 5% 1NF	4822 121 50566
C 1013	630V 1% 220PF	5322 121 54059
C 1014	100V 10% 10UF	5322 121 41727
C 1015	-20+20% 2200UF	5322 124 41086
C 1016	10% 1.5NF	4822 122 31169
C 1017	100V 10% 33NF	5322 121 42489
C 1018	-20+50% 10NF	4822 122 31414
C 1019	63V 10% 68NF	5322 121 42465
C 1020	-20+20%10000UF	5322 124 22236
C 1021	100V 10% 6.8NF	5322 121 42976
C 1022	-20+20% 330UF	5322 124 22095
C 1023	-20+20% 330UF	5322 124 22095
C 1024	-20+20% 100UF	5322 124 41383
C 1025	63V 10% 470NF	5322 121 42467
C 1026	-20+50% 10NF	4822 122 31414
C 1027	-20+20% 22UF	5322 124 41381
C 1028	-20+20% 68UF	5322 124 41384
C 1029	-20+20% 68UF	5322 124 41384
C 1030	-20+20% 68UF	5322 124 41384
C 1031	-20+20% 68UF	5322 124 41384
C 1032	-20+20% 68UF	5322 124 41384
C 1033	-20+20% 68UF	5322 124 41384
C 1034	-20+20% 22UF	5322 124 41381
C 1035	-20+20% 22UF	5322 124 41381
C 1036	-20+20% 10UF	5322 124 21731

ITEM	DESCRIPTION		SERV. NO.
10.8	**DIGITAL INTEGRATED CIRCUITS**		
D 0101	OQ0306		5322 209 11504
D 0102	P8031AH	INT	5322 209 11128
D 0103	PC74HC573P	PEL	5322 209 83271
D 0104	ROM 1-LYN		5322 209 51271
D 0105	UPD4464C-15	NEC	5322 209 50644
D 0106	PC74HC244P	PEL	5322 209 82861
D 0107	PC74HC244P	PEL	5322 209 82861
D 0108	PC74HC138P	PEL	5322 209 11335
D 0109	PC74HC32P	PEL	5322 209 70961
D 0110	PC74HC4538P	PEL	5322 209 11135
D 0111	PC74HC132P	PEL	5322 209 11194
D 0112	PC74HC574P	PEL	5322 209 11342
D 0113	PC74HC132P	PEL	5322 209 11194
D 0201	PCF8577T	PEL	5322 209 70024
D 0202	PCF8577T	PEL	5322 209 70024
D 0203	PCF8577T	PEL	5322 209 70024
D 0204	PCF8574P	PEL	5322 209 10883
D 0601	PC74HC109P	PEL	5322 209 11334
D 0602	PC74HC02P	PEL	5322 209 11331
D 0603	PC74HC08P	PEL	5322 209 11322
D 0604	PC74HC4053P	PEL	5322 209 11296
D 0605	HEF4006BP	PEL	4822 209 10552
D 0606	PC74HC132P	PEL	5322 209 11194
D 0607	PC74HC132P	PEL	5322 209 11194
D 0608	OQ 0300A		5322 209 11126
D 0609	OQ 0300A		5322 209 11126
D 0701	PC74HC132P	PEL	5322 209 11194
D 0702	OQ 0300A		5322 209 11126
D 0703	OQ 0300A		5322 209 11126
D 0801	HEF4052BP	PEL	4822 209 10263
D 0802	HEF4051BP	PEL	4822 209 10262
D 0803	HEF4053BP	PEL	5322 209 10576
D 0804	HEF4051BP	PEL	4822 209 10262
D 0805	PCF8574P	PEL	5322 209 10883
D 0806	PCF8574P	PEL	5322 209 10883
10.9	**MISCELLANEOUS**		
G 0101	CRYSTAL 12MHZ		5322 242 71523
G 0102	LITHIUM BATTERY		5322 138 10223
10.10	**OPTO DEVICES**		
H 0101	CQY54A-2	PEL	5322 130 80547
H 0102	CQY54A-2	PEL	5322 130 80547
H 0103	CQY54A-2	PEL	5322 130 80547
H 0104	PS20-01-0		5322 280 10148
H 0105	CNX36	PEL	5322 130 90097
H 0106	CNX36	PEL	5322 130 90097
H 0107	CNX36	PEL	5322 130 90097
H 0108	CNX36	PEL	5322 130 90097
H 0201	LCD LPH1409-1		5322 130 90443
H 0202	LCD LPH1409-1		5322 130 90443
H 0203	LCD LPH1409-1		5322 130 90443
H 0501	OP140SLC	OPT	5322 130 60654
H 0502	OP140SLC	OPT	5322 130 60654
H 0503	OP550SLC	OPT	5322 130 60655
H 0504	OP550SLC	OPT	5322 130 60655
H 0602	CNX36	PEL	5322 130 90097
H 0603	CNX36	PEL	5322 130 90097
H 0604	CNX36	PEL	5322 130 90097
H 0605	CNX36	PEL	5322 130 90097

ITEM	DESCRIPTION		SERV. NO.
H 0701	CNX36	PEL	5322 130 90097
H 0703	CNX36	PEL	5322 130 90097
H 0704	CNX36	PEL	5322 130 90097
H 0705	CNX36	PEL	5322 130 90097
H 0706	CQY54A-2	PEL	5322 130 80547
H 0707	CQY54A-2	PEL	5322 130 80547
H 1001	CQY54A-2	PEL	5322 130 80547
H 1002	CQY54A-2	PEL	5322 130 80547
H 1101	GP2S02C		5322 130 50457
H 1102	GP2S02C		5322 130 50457
H 1103	GP2S02C		5322 130 50457
H 1201	GP2S02C		5322 130 50457
H 1301	GP2S02C		5322 130 50457

10.11 RELAIS

K 0801	2MBC		5322 280 80473
K 0802	REED RELAY		5322 280 20122
K 0803	REED RELAY		5322 280 20122

10.12 COILS

L 0101	100UH	TDK	5322 157 52363
L 0601	470UH	TDK	5322 157 52362
L 0602	470UH	TDK	5322 157 52362
L 0701	470UH	TDK	5322 157 52362
L 0702	470UH	TDK	5322 157 52362
L 0801	470UH	TDK	5322 157 52362
L 1001	100UH	TDK	5322 157 52363
L 1002	82UH		4822 158 10563
L 1003	5.6UH		4822 157 52259
L 1004	100UH	TDK	5322 157 52363
L 1005	470UH	TDK	5322 157 52362
L 1006	6.8UH	TDK	5322 157 53031

10.13 ANALOG INTEGRATED CIRCUITS

N 0101	TL7705ACP	T.I	4822 209 82386
N 0102	LM393N	NSC	4822 209 80797
N 0103	LM393N	NSC	4822 209 80797
N 0501	LM358N	N.S	4822 209 70672
N 0502	LM393N	NSC	4822 209 80797
N 0601	TDA1534	PEL	5322 209 71649
N 0602	LM78L05ACZ	N.S	5322 209 80903
N 0603	LM79L05ACZ	N.S	5322 209 86434
N 0604	LM79L15ACZ	N.S	5322 209 82751
N 0701	LM324N	N.S	4822 209 80587
N 0702	LM324N	N.S	4822 209 80587
N 0703	NE5532P	T.I	5322 209 83339
N 0704	LM393N	NSC	4822 209 80797
N 0705	UA555TC	FSC	5322 209 71648
N 0706	LM78L05ACZ	N.S	5322 209 80903
N 0801	LTC1052CN8	L.T	5322 209 83378
N 0802	UA308ATC	FSC	5322 209 83377
N 0803	LM324N	N.S	4822 209 80587
N 0804	OP-07CZ	PMI	5322 209 83268
N 0805	UA431AWC	FSC	5322 209 83217
N 0806	LM78L05ACZ	N.S	5322 209 80903
N 0807	UA308ATC	FSC	5322 209 83377
N 0808	LM79L05ACZ		5322 209 86434
N 1001	LM358N	N.S	4822 209 70672

ITEM	DESCRIPTION	SERV. NO.
10.14	RESISTORS	
R 0101	MRS25 1% 46K4	5322 116 53314
R 0102	MRS25 1% 46K4	5322 116 53314
R 0105	MRS25 1% 100K	4822 116 52973
R 0106	MRS25 1% 8K25	5322 116 53267
R 0107	MRS25 1% 8K25	5322 116 53267
R 0108	MRS25 1% 511E	5322 116 53135
R 0109	MRS25 1% 8K25	5322 116 53267
R 0110	MRS25 1% 825E	5322 116 53541
R 0111	MRS25 1% 3K32	5322 116 53211
R 0112	MRS25 1% 46K4	5322 116 53314
R 0113	-105-333 33K	5322 111 91345
R 0114	-105-333 33K	5322 111 91345
R 0115	-105-103 10K	5322 111 90473
R 0116	MRS25 1% 10K	4822 116 53022
R 0117	-105-103 10K	5322 111 90473
R 0118	-105-103 10K	5322 111 90473
R 0119	MRS25 1% 2K05	5322 116 53324
R 0120	MRS25 1% 115K	4822 116 52947
R 0121	MRS25 1% 115K	4822 116 52947
R 0122	MRS25 1% 825E	5322 116 53541
R 0123	MRS25 1% 46K4	5322 116 53314
R 0124	MRS25 1% 909E	4822 116 53533
R 0125	MRS25 1% 649E	5322 116 53646
R 0126	MRS25 1% 649E	5322 116 53646
R 0127	MRS25 1% 10K	4822 116 53022
R 0128	MRS25 1% 10K	4822 116 53022
R 0129	MRS25 1% 332E	5322 116 53329
R 0130	MRS25 1% 332E	5322 116 53329
R 0131	MRS25 1% 332E	5322 116 53329
R 0132	-105-103 10K	5322 111 90473
R 0133	MRS25 1% 1M	4822 116 52843
R 0134	MRS25 1% 1M	4822 116 52843
R 0135	MRS25 1% 1M	4822 116 52843
R 0136	MRS25 1% 1M	4822 116 52843
R 0137	MRS25 1% 100K	4822 116 52973
R 0138	MRS25 1% 487E	5322 116 53642
R 0139	MRS25 1% 487E	5322 116 53642
R 0140	MRS25 1% 487E	5322 116 53642
R 0141	MRS25 1% 487E	5322 116 53642
R 0142	MRS25 1% 1M	4822 116 52843
R 0201	CMP10L 20% 22K	5322 101 10801
R 0202	CMP10L 20% 22K	5322 101 10801
R 0203	MRS25 1% 1M	4822 116 52843
R 0204	MRS25 1% 100E	5322 116 53126
R 0205	MRS25 1% 100E	5322 116 53126
R 0206	MRS25 1% 100E	5322 116 53126
R 0207	MRS25 1% 100E	5322 116 53126
R 0401	3.5W 5% 150E	4822 112 21085
R 0402	6E5	5322 116 40119
R 0403	MRS25 1% 20K5	5322 116 53238
R 0404	MRS25 1% 8K25	5322 116 53267
R 0405	MRS25 1% 10K	4822 116 53022
R 0406	MRS25 1% 10K	4822 116 53022
R 0421	3.5W 5% 150E	4822 112 21085
R 0422	6E5	5322 116 40119
R 0423	MRS25 1% 20K5	5322 116 53238
R 0424	MRS25 1% 8K25	5322 116 53267
R 0425	MRS25 1% 10K	4822 116 53022
R 0426	MRS25 1% 10K	4822 116 53022
R 0441	3.5W 5% 150E	4822 112 21085
R 0442	6E5	5322 116 40119
R 0443	MRS25 1% 20K5	5322 116 53238
R 0444	MRS25 1% 8K25	5322 116 53267

ITEM	DESCRIPTION	SERV. NO.
R 0445	MRS25 1% 3K01	5322 116 53255
R 0446	MRS25 1% 3K01	5322 116 53255
R 0501	MRS25 1% 332K	5322 116 53644
R 0502	MRS25 1% 332K	5322 116 53644
R 0503	-101-222 2K2	5322 111 91238
R 0504	-102-223 22K	5322 111 91239
R 0505	-102-332 3K3	5322 111 91347
R 0506	MRS25 1% 332K	5322 116 53331
R 0507	MRS25 1% 332K	5322 116 53331
R 0508	MRS25 1% 332K	5322 116 53331
R 0509	MRS25 1% 332K	5322 116 53331
R 0601	MTP10 20% 330E	5322 101 14244
R 0602	0.1% 2K37	5322 116 53171
R 0603	MTP10 20% 330E	5322 101 14244
R 0604	MRS25 1% 261E	5322 116 53549
R 0605	0.1% 2K34	5322 116 80249
R 0606	0.1% 1K23	5322 116 80226
R 0607	0.1% 162E	5322 116 80248
R 0609	MRS25 1% 10K	4822 116 53022
R 0610	MRS25 1% 10K	4822 116 53022
R 0611	MRS25 1% 10K	4822 116 53022
R 0612	MRS25 1% 5K62	5322 116 53495
R 0613	MRS25 1% 5K62	5322 116 53495
R 0614	MRS25 1% 5K62	5322 116 53495
R 0615	MRS25 1% 5K62	5322 116 53495
R 0616	-105-473 47K	5322 111 90808
R 0617	MRS25 1% 825E	5322 116 53541
R 0618	MRS25 1% 825E	5322 116 53541
R 0619	MRS25 1% 825E	5322 116 53541
R 0620	MRS25 1% 825E	5322 116 53541
R 0621	MRS25 1% 825E	5322 116 53541
R 0622	MRS25 1% 825E	5322 116 53541
R 0623	MRS25 1% 5K62	5322 116 53495
R 0624	MRS25 1% 4K64	5322 116 53212
R 0625	10K 1% 0,6W	4822 116 53022
R 0626	MRS25 1% 10K	4822 116 53022
R 0627	MRS25 1% 464E	5322 116 53232
R 0628	MRS25 1% 10K	4822 116 53022
R 0629	MRS25 1% 11K	4822 116 52907
R 0630	MRS25 1% 11K	4822 116 52907
R 0632	MRS25 1% 226E	5322 116 53242
R 0633	MRS25 1% 10K	4822 116 53022
R 0634	MRS25 1% 226E	5322 116 53242
R 0635	MRS25 1% 205E	5322 116 53633
R 0636	MRS25 1% 8K25	5322 116 53267
R 0637	BRUGDRAAD	5322 267 30884
R 0638	MRS25 1% 11K	4822 116 52907
R 0639	MRS25 1% 40K2	5322 116 53613
R 0701	MRS25 1% 8K25	5322 116 53267
R 0702	MRS25 1% 11K	4822 116 52907
R 0703	BRUGDRAAD	5322 267 30884
R 0704	MRS25 1% 226E	5322 116 53242
R 0706	MRS25 1% 226E	5322 116 53242
R 0707	MRS25 1% 10K	4822 116 53022
R 0708	MRS25 1% 4K64	5322 116 53212
R 0709	MRS25 1% 10K	4822 116 53022
R 0710	10K 1% 0,6W	4822 116 53022
R 0711	MRS25 1% 10K	4822 116 53022
R 0712	MRS25 1% 226E	5322 116 53242
R 0713	MRS25 1% 11K	4822 116 52907
R 0714	MRS25 1% 11K	4822 116 52907
R 0715	BRUGDRAAD	5322 267 30884
R 0716	BRUGDRAAD	5322 267 30884
R 0717	MRS25 1% 5K62	5322 116 53495
R 0718	MRS25 1% 5K62	5322 116 53495

ITEM	DESCRIPTION	SERV. NO.
R 0719	MRS25 1% 46K4	5322 116 53314
R 0720	MRS25 1% 825E	5322 116 53541
R 0721	MRS25 1% 46K4	5322 116 53314
R 0722	MRS25 1% 825E	5322 116 53541
R 0723	MRS25 1% 46K4	5322 116 53314
R 0724	MRS25 1% 825E	5322 116 53541
R 0725	MRS25 1% 10K	4822 116 53022
R 0729	MRS25 1% 1K	4822 116 53108
R 0730	MRS25 1% 4K87	5322 116 53333
R 0731	MRS25 1% 20K5	5322 116 53238
R 0732	MRS25 1% 442K	5322 116 80146
R 0733	MRS25 1% 71K5	5322 116 53623
R 0734	MRS25 1% 20K5	5322 116 53238
R 0735	MRS25 1% 1K	4822 116 53108
R 0736	MRS25 1% 59K	4822 116 80036
R 0737	MRS25 1% 2K05	5322 116 53324
R 0738	MRS25 1% 681E	4822 116 53123
R 0739	MRS25 1% 86K6	5322 116 80357
R 0740	MRS25 1% 59K	4822 116 80036
R 0741	MRS25 1% 59K	4822 116 80036
R 0742	MRS25 1% 3K32	5322 116 53211
R 0743	MTP10 20% 1K5	5322 101 14214
R 0744	MRS25 1% 3K83	4822 116 53079
R 0745	MRS25 1% 38K3	4822 116 53526
R 0746	MRS25 1% 4K87	5322 116 53333
R 0747	MRS25 1% 1K	4822 116 53108
R 0748	MTP10 20% 22K	5322 100 10118
R 0749	MRS25 1% 6K81	5322 116 53252
R 0750	MRS25 1% 1K	4822 116 53108
R 0751	MRS25 1% 20K5	5322 116 53238
R 0752	MRS25 1% 1K96	5322 116 53237
R 0753	MRS25 1% 23K7	5322 116 53537
R 0754	MRS25 1% 2K61	5322 116 53327
R 0755	MRS25 1% 1K	4822 116 53108
R 0756	MRS25 1% 1K	4822 116 53108
R 0757	MTP10 20% 22K	5322 100 10118
R 0758	MRS25 1% 100K	4822 116 52973
R 0759	MRS25 1% 1K	4822 116 53108
R 0801	0.1% 1M	5322 116 80243
R 0802	MRS25 1% 1K	4822 116 53108
R 0803	0.1% 1M	5322 116 80243
R 0804	0.1% 100K	5322 116 51703
R 0805	MRS25 1% 100K	4822 116 52973
R 0806	0.1% 100K	5322 116 51703
R 0807	0.1% 113E	5322 116 80217
R 0808	0.1% 10K	5322 116 51702
R 0809	0.1% 1K	5322 116 52698
R 0810	MRS25 1% 6K65	5322 116 80124
R 0811	VR25 5% 10M	4822 110 72214
R 0812	VR25 5% 10M	4822 110 72214
R 0813	MRS25 1% 11K	4822 116 52907
R 0814	MRS25 1% 71K5	5322 116 53623
R 0815	MRS25 1% 162K	5322 116 53535
R 0816	MRS25 1% 162K	5322 116 53535
R 0817	MRS25 1% 487K	5322 116 80227
R 0818	0.1% 3K4	5322 116 80223
R 0819	0.1% 681E	5322 116 80219
R 0820	0.1% 1K02	5322 116 80221
R 0821	0.1% 340E	5322 116 80218
R 0822	0.1% 1K35	5322 116 80225
R 0823	MRS25 1% 10E	4822 116 52891
R 0824	MRS25 1% 20K5	5322 116 53238
R 0825	MTP10 20% 22K	5322 100 10118
R 0826	MRS25 1% 464K	5322 116 53247
R 0827	MRS25 1% 140E	5322 116 53542

ITEM	DESCRIPTION	SERV. NO.
R 0828	CMP10L 20% 22K	5322 101 10802
R 0829	0.1% 5K11	5322 116 52706
R 0830	MRS25 1% 2K61	5322 116 53327
R 0831	MRS25 1% 1M	4822 116 52843
R 0832	MTP10 20% 22K	5322 100 10118
R 0833	0.1% 5K11	5322 116 52706
R 0834	FOR CHANNELS 1+2	5322 116 52706
R 0834	FOR CHART CHANNEL	5322 116 80406
R 0835	0.1% 5K11	5322 116 52706
R 0836	MRS25 1% 90K9	5322 116 53582
R 0837	CMP10L 20% 22K	5322 101 10802
R 0838	0.1% 102K	5322 116 80224
R 0839	MRS25 1% 200E	5322 116 53731
R 0840	0.1% 10K	5322 116 51702
R 0841	0.1% 1K13	5322 116 80222
R 0842	MRS25 1% 66K5	5322 116 80228
R 0843	0.1% 5K11	5322 116 52706
R 0844	0.1% 2K	5322 116 51812
R 0845	0.1% 2K	5322 116 51812
R 0846	0.1% 1K	5322 116 52698
R 0847	0.1% 1K	5322 116 52698
R 0848	0.1% 1K	5322 116 52698
R 0849	0.1% 1K	5322 116 52698
R 0850	0.1% 5K11	5322 116 52706
R 0851	MRS25 1% 2K49	5322 116 53574
R 0852	MRS25 1% 7K15	5322 116 80125
R 0854	MTP10 20% 680E	5322 101 14209
R 0855	VR25 5% 10M	4822 110 72214
R 0856	MRS25 1% 46K4	5322 116 53314
R 0857	MRS25 1% 90K9	5322 116 53582
R 0858	VR25 5% 5M6	4822 110 72207
R 0859	MRS25 1% 2K61	5322 116 53327
R 0860	MRS25 1% 11K	4822 116 52907
R 0861	MRS25 1% 14K	5322 116 80103
R 0862	MPR24 .1% 10K2	5322 116 51779
R 0863	0.1% 2K	5322 116 51812
R 0864	FOR CHART CHANNEL	5322 116 52697
R 0865	MRS25 1% 100E	5322 116 53126
R 0866	MRS25 1% 100E	5322 116 53126
R 1001	1.7A 20% 82E	4822 116 30069
R 1002	MRS25 1% 147K	5322 116 53256
R 1003	MRS25 1% 147K	5322 116 53256
R 1004	MRS25 1% 4K64	5322 116 53212
R 1005	MRS25 1% 2E15	5322 116 53722
R 1006	MRS25 1% 464E	5322 116 53232
R 1007	MRS25 1% 2K61	5322 116 53327
R 1008	MRS25 1% 100E	5322 116 53126
R 1009	MRS25 1% 4K64	5322 116 53212
R 1010	0.5W 10% 3K3	5322 116 30234
R 1011	MRS25 1% 100E	5322 116 53126
R 1012	MRS25 1% 1E	4822 116 52976
R 1013	MRS25 1% 1E	4822 116 52976
R 1014	MRS25 1% 316E	5322 116 53514
R 1015	MRS25 1% 316E	5322 116 53514
R 1016	MRS25 1% 51E1	5322 116 53213
R 1017	MRS25 1% 100K	4822 116 52973
R 1018	MRS25 1% 51E1	5322 116 53213
R 1019	MRS25 1% 4K42	5322 116 53578
R 1020	3.5W 10% 0E15	5322 113 41264
R 1021	MRS25 1% 10K	4822 116 53022
R 1022	MRS25 1% 7E5	4822 116 53014
R 1023	MRS25 1% 100E	5322 116 53126
R 1024	0.5W 10% 1K5	4822 116 30248
R 1025	MRS25 1% 1K	4822 116 53108
R 1026	MRS25 1% 100E	5322 116 53126

ITEM	DESCRIPTION		SERV. NO.
R 1027	MRS25	1% 51K1	4822 116 53121
R 1028	MRS25	1% 1K	4822 116 53108
R 1029	MRS25	1% 3K83	4822 116 53079
R 1030	MRS25	1% 365E	5322 116 53575
R 1032	MRS25	1% 1K	4822 116 53108
R 1033	MRS25	1% 2K74	4822 116 53055
R 1034	MRS25	1% 2K74	4822 116 53055
R 1101	MRS25	1% 953E	5322 116 80229
R 1102	MRS25	1% 649E	5322 116 53646
R 1103	MRS25	1% 953E	5322 116 80229
R 1104	MRS25	1% 649E	5322 116 53646
R 1105	MRS25	1% 953E	5322 116 80229
R 1106	MRS25	1% 649E	5322 116 53646
R 1201	MRS25	1% 953E	5322 116 80229
R 1202	MRS25	1% 649E	5322 116 53646
R 1301	MRS25	1% 953E	5322 116 80229
R 1302	MRS25	1% 6K81	5322 116 53252

10.15 SWITCHES

S 0001	MAINS SWITCH		5322 277 10974
S 0101	1-P 20V AC/DC		5322 276 12202
S 0201	1-P		4822 276 11076
S 0202 - S 0226	1-P		4822 276 11076

10.16 TRANSFORMERS

T 1001	TRANSFORMER		5322 146 30609
T 1002	TRANSFORMER		5322 146 30611

10.17 SEMI CONDUCTORS

V 0101	BAX12 DO-35	PEL		5322 130 34605
V 0102	BAX12 DO-35	PEL		5322 130 34605
V 0103	BAX12 DO-35	PEL		5322 130 34605
V 0104	BZX79-C4V3	PEL		4822 130 31554
V 0105	BC557B	PEL		4822 130 44568
V 0106	BC547B	PEL		4822 130 40959
V 0107	BAX12 DO-35	PEL		5322 130 34605
V 0108	BC547B	PEL		4822 130 40959
V 0109	BC547B	PEL		4822 130 40959
V 0110	BYV10-40	PEL		4822 130 32245
V 0111	BAW62	PEL		4822 130 30613
V 0112	BC547B	PEL		4822 130 40959
V 0113	BC547B	PEL		4822 130 40959
V 0114	BC547B	PEL		4822 130 40959
V 0115	BC547B	PEL		4822 130 40959
V 0116	BAW62	PEL		4822 130 30613
V 0117	BAW62	PEL		4822 130 30613
V 0118	BC547B	PEL		4822 130 40959
V 0119	BC547B	PEL		4822 130 40959
V 0120	BC547B	PEL		4822 130 40959
V 0121	BC547B	PEL		4822 130 40959
V 0122	BAW62	PEL		4822 130 30613
V 0123	BST70A FET			5322 130 42709
V 0124	BST70A		PHIN	5322 130 42709
V 0125	BZX79-B33			4822 130 34142
V 0126	BZX79-B33			4822 130 34142
V 0401	BC547B	PEL		4822 130 40959
V 0402	BZX79-C12	PEL		4822 130 34197

ITEM	DESCRIPTION		SERV. NO.
V 0403	BC547B	PEL	4822 130 40959
V 0404	BC557B	PEL	4822 130 44568
V 0405	BD937	PEL	5322 130 60244
V 0406	BD938	PEL	5322 130 42029
V 0407	BYV27-150	PEL	4822 130 31628
V 0408	BYV27-150	PEL	4822 130 31628
V 0409	BC547B	PEL	4822 130 40959
V 0410	BC557B	PEL	4822 130 44568
V 0411	BD937	PEL	5322 130 60244
V 0412	BD938	PEL	5322 130 42029
V 0413	BYV27-150	PEL	4822 130 31628
V 0414	BYV27-150	PEL	4822 130 31628
V 0421	BC547B	PEL	4822 130 40959
V 0422	BZX79-C12	PEL	4822 130 34197
V 0423	BC547B	PEL	4822 130 40959
V 0424	BC557B	PEL	4822 130 44568
V 0425	BD937	PEL	5322 130 60244
V 0426	BD938	PEL	5322 130 42029
V 0427	BYV27-150	PEL	4822 130 31628
V 0428	BYV27-150	PEL	4822 130 31628
V 0429	BC547B	PEL	4822 130 40959
V 0430	BC557B	PEL	4822 130 44568
V 0431	BD937	PEL	5322 130 60244
V 0432	BD938	PEL	5322 130 42029
V 0433	BYV27-150	PEL	4822 130 31628
V 0434	BYV27-150	PEL	4822 130 31628
V 0441	BC547B	PEL	4822 130 40959
V 0442	BZX79-C12	PEL	4822 130 34197
V 0443	BC547B	PEL	4822 130 40959
V 0444	BC557B	PEL	4822 130 44568
V 0445	BD937	PEL	5322 130 60244
V 0446	BD938	PEL	5322 130 42029
V 0447	BYV27-150	PEL	4822 130 31628
V 0448	BYV27-150	PEL	4822 130 31628
V 0449	BC547B	PEL	4822 130 40959
V 0450	BC557B	PEL	4822 130 44568
V 0451	BD937	PEL	5322 130 60244
V 0452	BD938	PEL	5322 130 42029
V 0453	BYV27-150	PEL	4822 130 31628
V 0454	BYV27-150	PEL	4822 130 31628
V 0601	BZV46-C2V0	PEL	4822 130 31248
V 0701	BAX12 DO-35	PEL	5322 130 34605
V 0702	BAX12 DO-35	PEL	5322 130 34605
V 0703	BZX79-C9V1	PEL	4822 130 30862
V 0704	BZV46-C2V0	PEL	4822 130 31248
V 0705	BZV46-C2V0	PEL	4822 130 31248
V 0706	BZX79-C6V8	PEL	4822 130 34278
V 0707	BAX12 DO-35	PEL	5322 130 34605
V 0708	BAX12 DO-35	PEL	5322 130 34605
V 0709	BZX79-C3V0	PEL	4822 130 31881
V 0710	BZX79-B4V7		4822 130 34174
V 0711	BZX79-C7V5	PEL	4822 130 30861
V 0801	BZX79-C4V3		4822 130 31554
V 0802	BZX79-C4V3		4822 130 31554
V 0803	BAS45		5322 130 32256
V 0804	BAS45		5322 130 32256
V 0805	BAX12 DO-35	PEL	5322 130 34605
V 0806	BAX12 DO-35	PEL	5322 130 34605
V 0807	BC547B	PEL	4822 130 40959
V 0808	BC557B	PEL	4822 130 44568
V 1001	BYW56	PEL	5322 130 34973
V 1002	BYW56	PEL	5322 130 34973
V 1003	BYW56	PEL	5322 130 34973
V 1004	BYW56	PEL	5322 130 34973
V 1005	BAX12 DO-35	PEL	5322 130 34605

ITEM	DESCRIPTION		SERV. NO.
V 1006	BAX12 DO-35	PEL	5322 130 34605
V 1007	BAX12 DO-35	PEL	5322 130 34605
V 1008	BAX12 DO-35	PEL	5322 130 34605
V 1009	BC337	PEL	4822 130 40855
V 1010	BZX79-C7V5	PEL	4822 130 30861
V 1011	BRY39	PEL	5322 130 40482
V 1012	BAV10	PEL	4822 130 30594
V 1013	BZX79-C24		4822 130 34398
V 1014	BC337	PEL	4822 130 40855
V 1015	BAX12 DO-35	PEL	5322 130 34605
V 1016	BAX12 DO-35	PEL	5322 130 34605
V 1017	BAX12 DO-35	PEL	5322 130 34605
V 1018	BAX12 DO-35	PEL	5322 130 34605
V 1019	BAX12 DO-35	PEL	5322 130 34605
V 1020	BUV83	PEL	5322 130 50406
V 1021	BUW12A	PEL	5322 130 42114
V 1022	BYV26C	PEL	4822 130 32343
V 1023	BYV26C	PEL	4822 130 32343
V 1024	BYV26C	PEL	4822 130 32343
V 1025	BYV32-150	PEL	5322 130 31637
V 1026	BYV32-150	PEL	5322 130 31637
V 1027	BZV85-C30	PEL	5322 130 32702
V 1028	BYV19-45	PEL	5322 130 32703
V 1029	BYV27-150	PEL	4822 130 31628
V 1030	BYV27-150	PEL	4822 130 31628
V 1031	BUZ20	PEL	5322 130 60653
V 1032	BRY39	PEL	5322 130 40482
V 1033	BAX12 DO-35	PEL	5322 130 34605
V 1034	BYV33-45	PEL	5322 130 32246
V 1035	BYV33-45	PEL	5322 130 32246
V 1036	BZX79-C5V6	PEL	4822 130 34173
V 1037	BZX79-C5V1	PEL	4822 130 34233
V 1038	BAT85	PEL	4822 130 31983
V 1039	BZX79-C3V0	PEL	4822 130 31881
V 1040	BAW62	PEL	4822 130 30613
V 1041	BYV10-40	PEL	4822 130 32245
V 1042	BYV10-40	PEL	4822 130 32245
V 1043	BYV10-40	PEL	4822 130 32245
V 1044	BYV10-40	PEL	4822 130 32245
V 1045	BYV10-40	PEL	4822 130 32245
V 1046	BYV10-40	PEL	4822 130 32245
V 1047	BAX12 DO-35	PEL	5322 130 34605
V 1048	BAX12 DO-35	PEL	5322 130 34605
V 1049	BC547B	PEL	4822 130 40959
V 1051	BZX79-C3V0	PEL	4822 130 31881
V 1101	BC547B	PEL	4822 130 40959
V 1102	BC547B	PEL	4822 130 40959
V 1103	BC547B	PEL	4822 130 40959
V 1201	BC547B	PEL	4822 130 40959
V 1301	BC547B	PEL	4822 130 40959

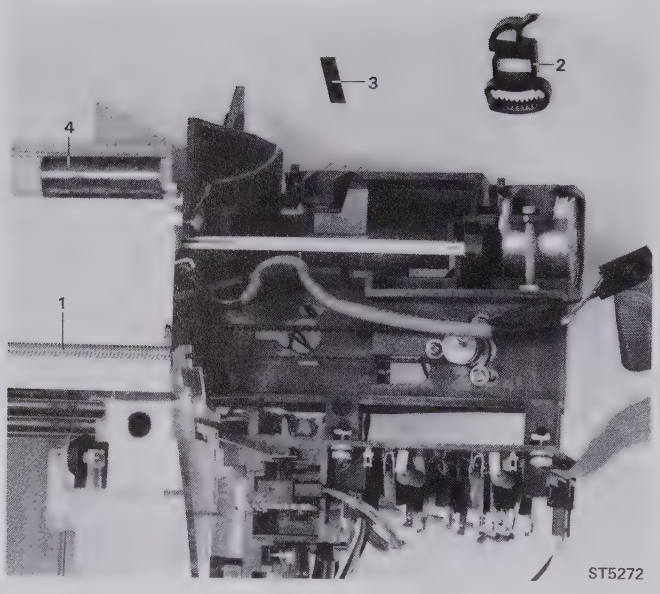


Figure 10.1

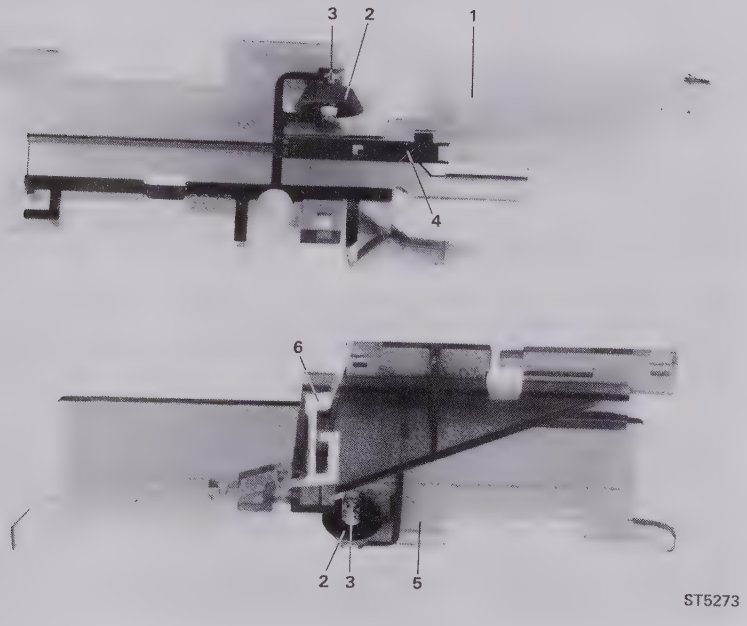


Figure 10.2

11. CIRCUIT DIAGRAMS & P.B.C. LAYOUTS

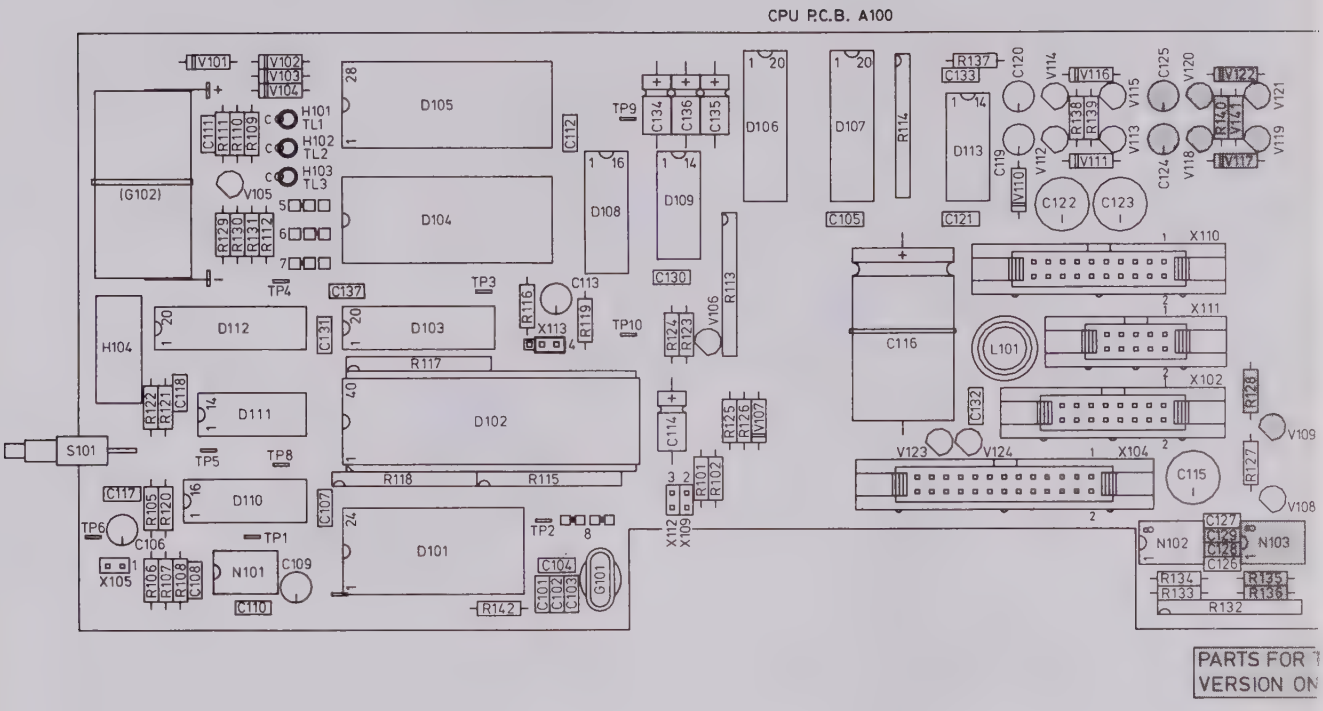


Figure 11.1 CPU p.c.b. A100, component side old version

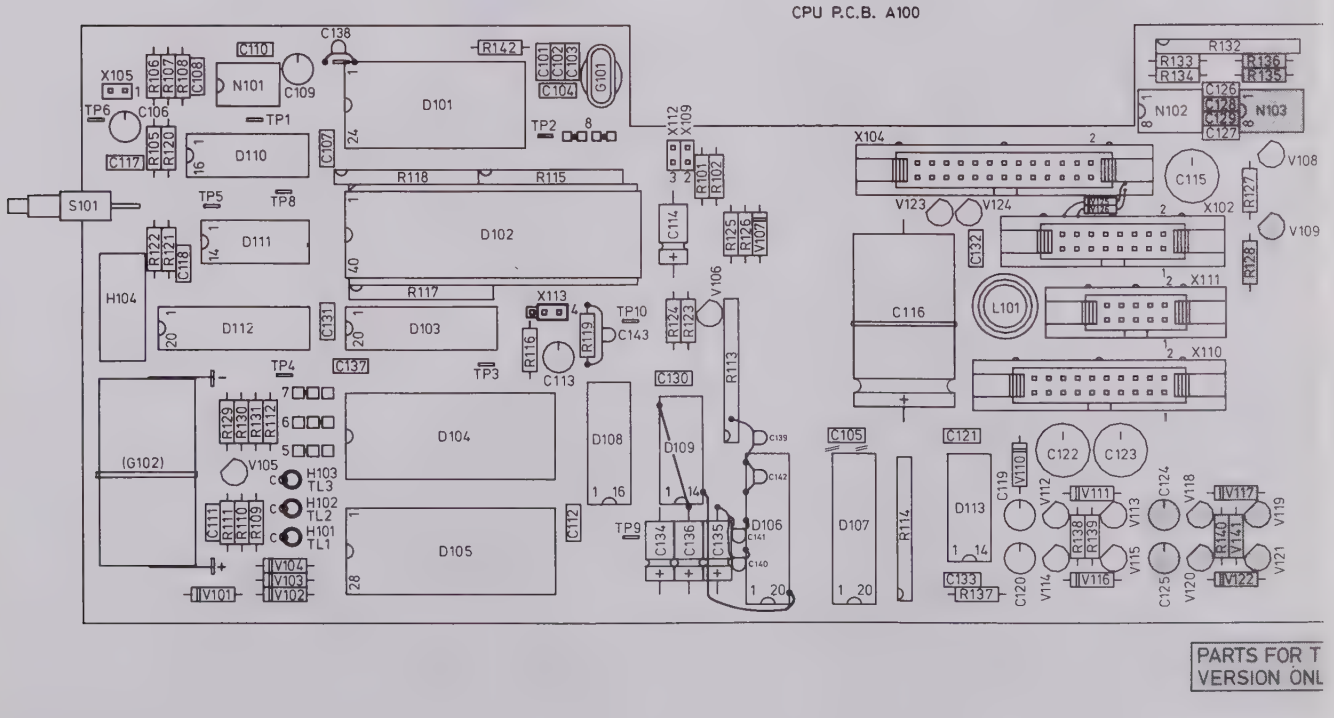


Figure 11.2 CPU p.c.b. A100, conductor side old version

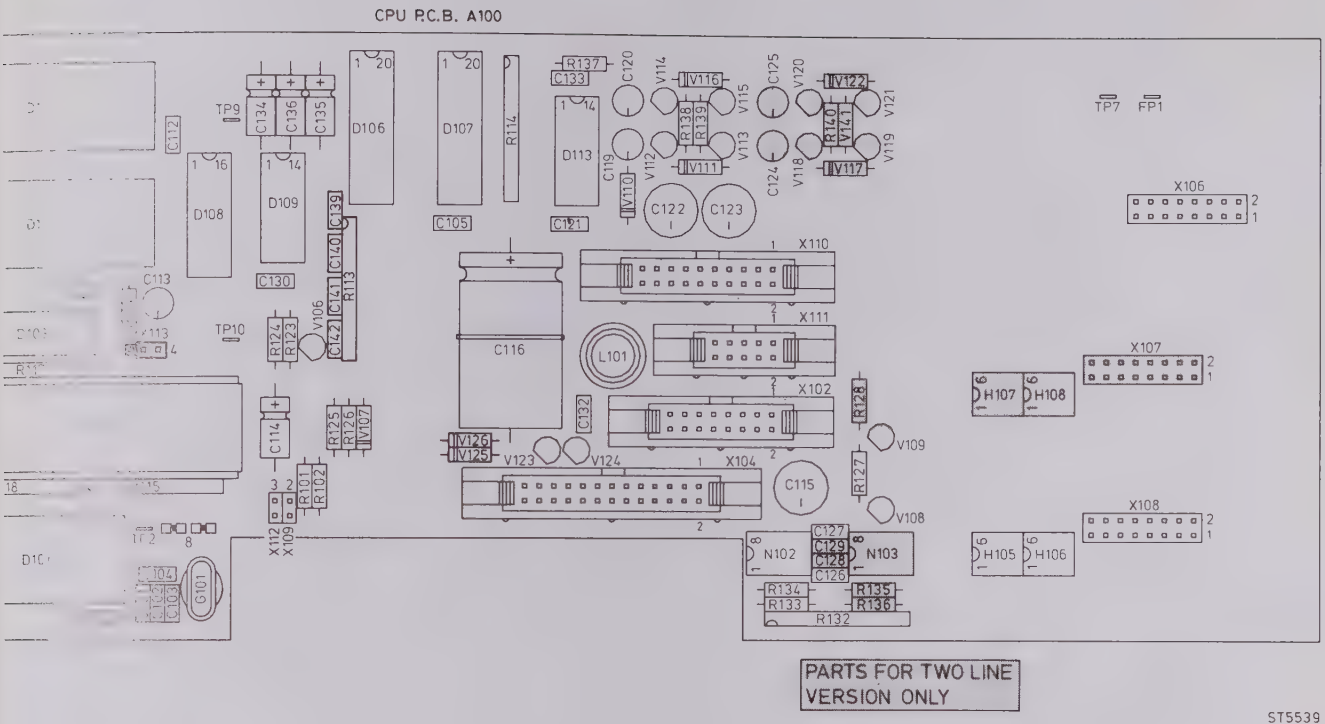


Figure 11.3 CPU p.c.b. A100, component side new version

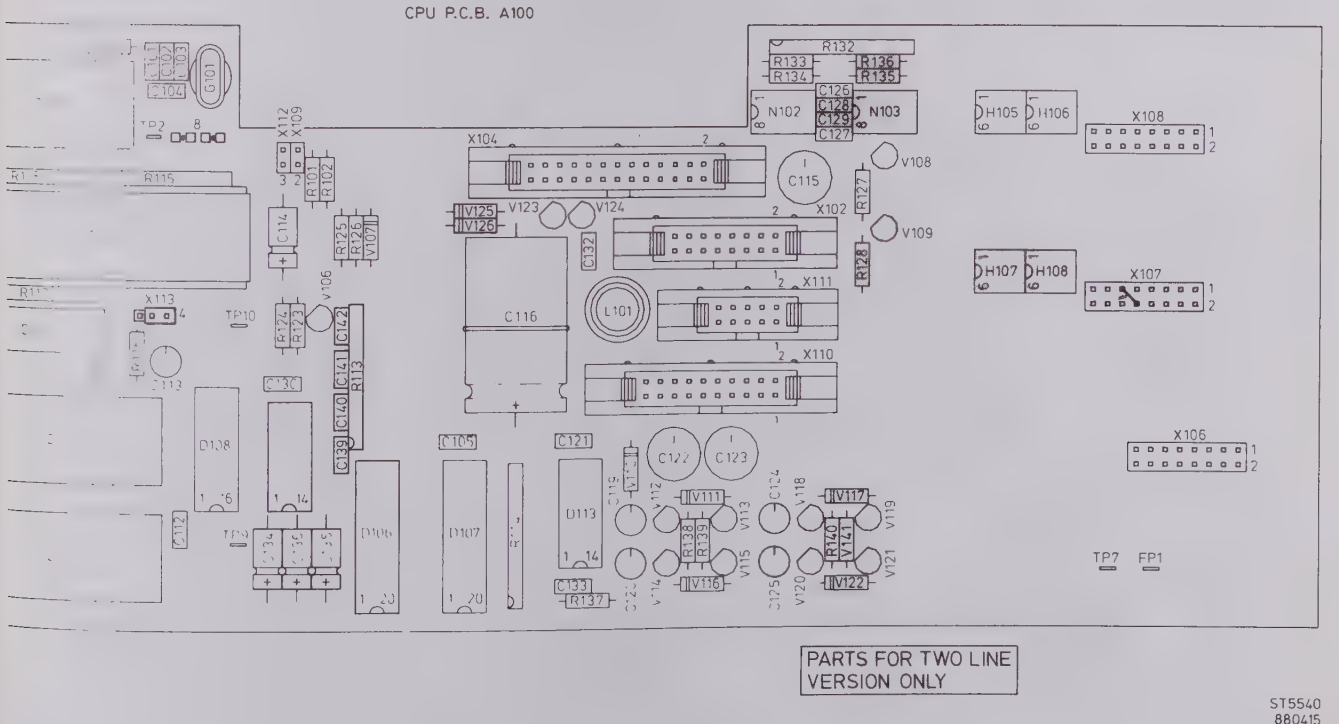
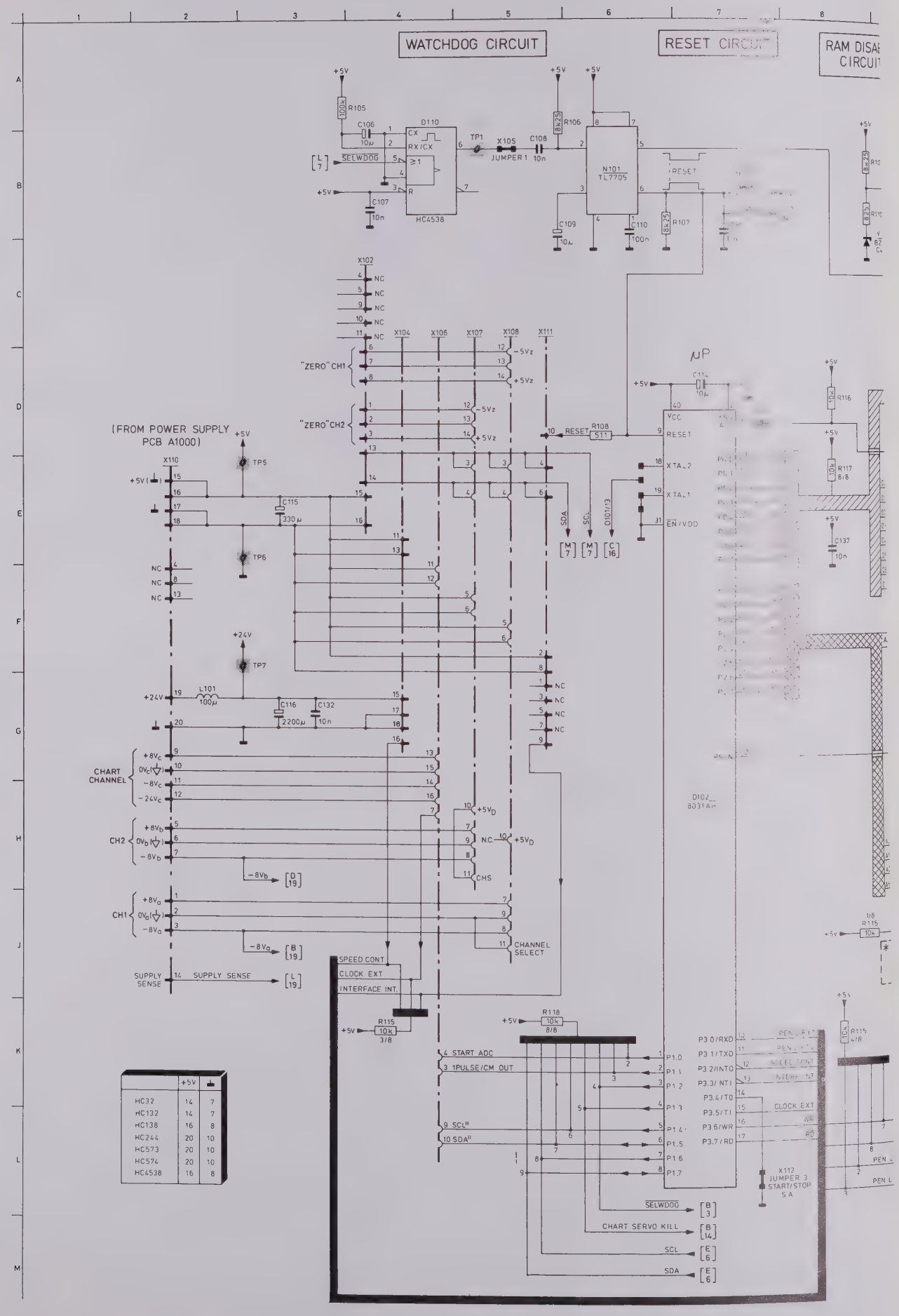
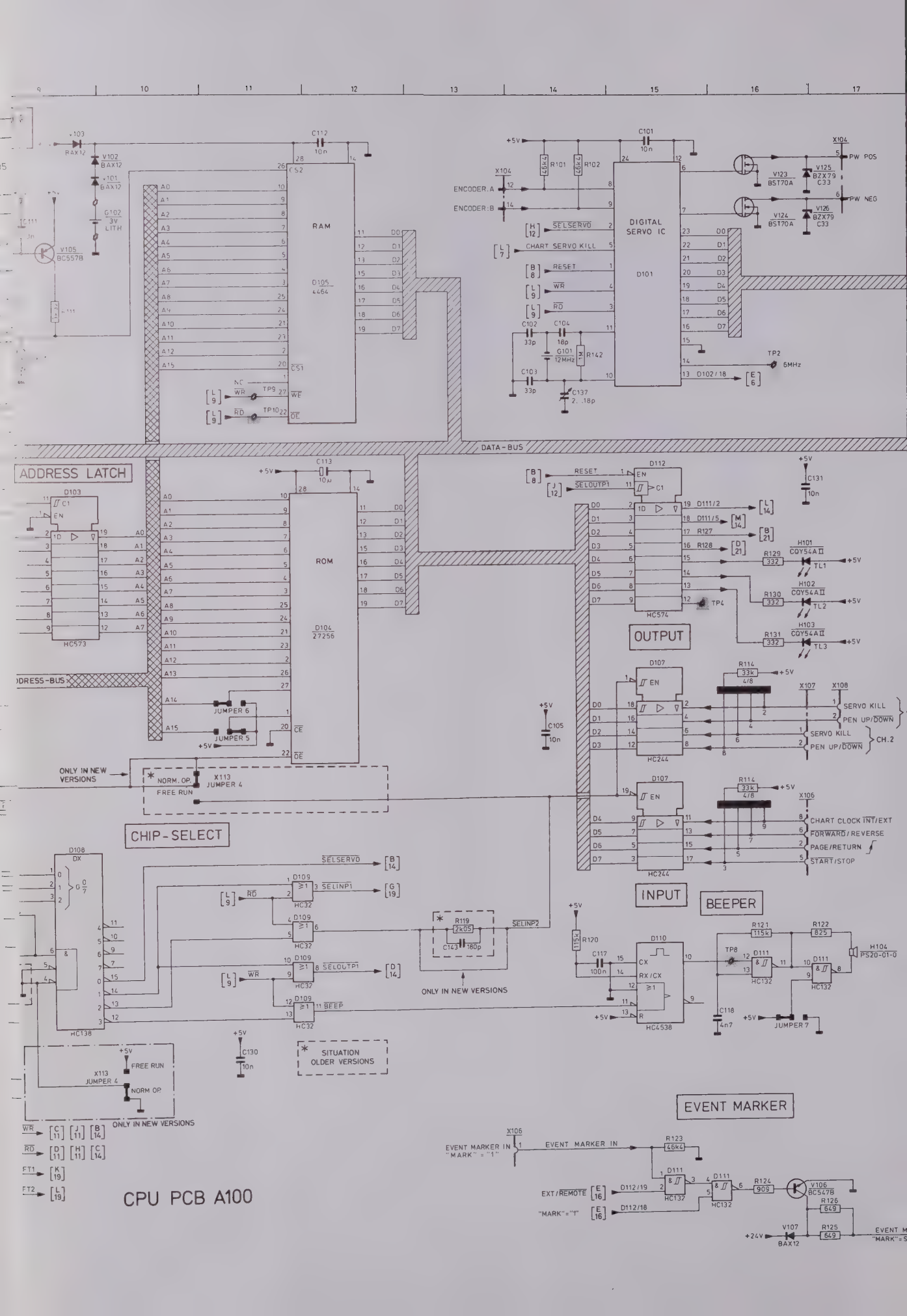
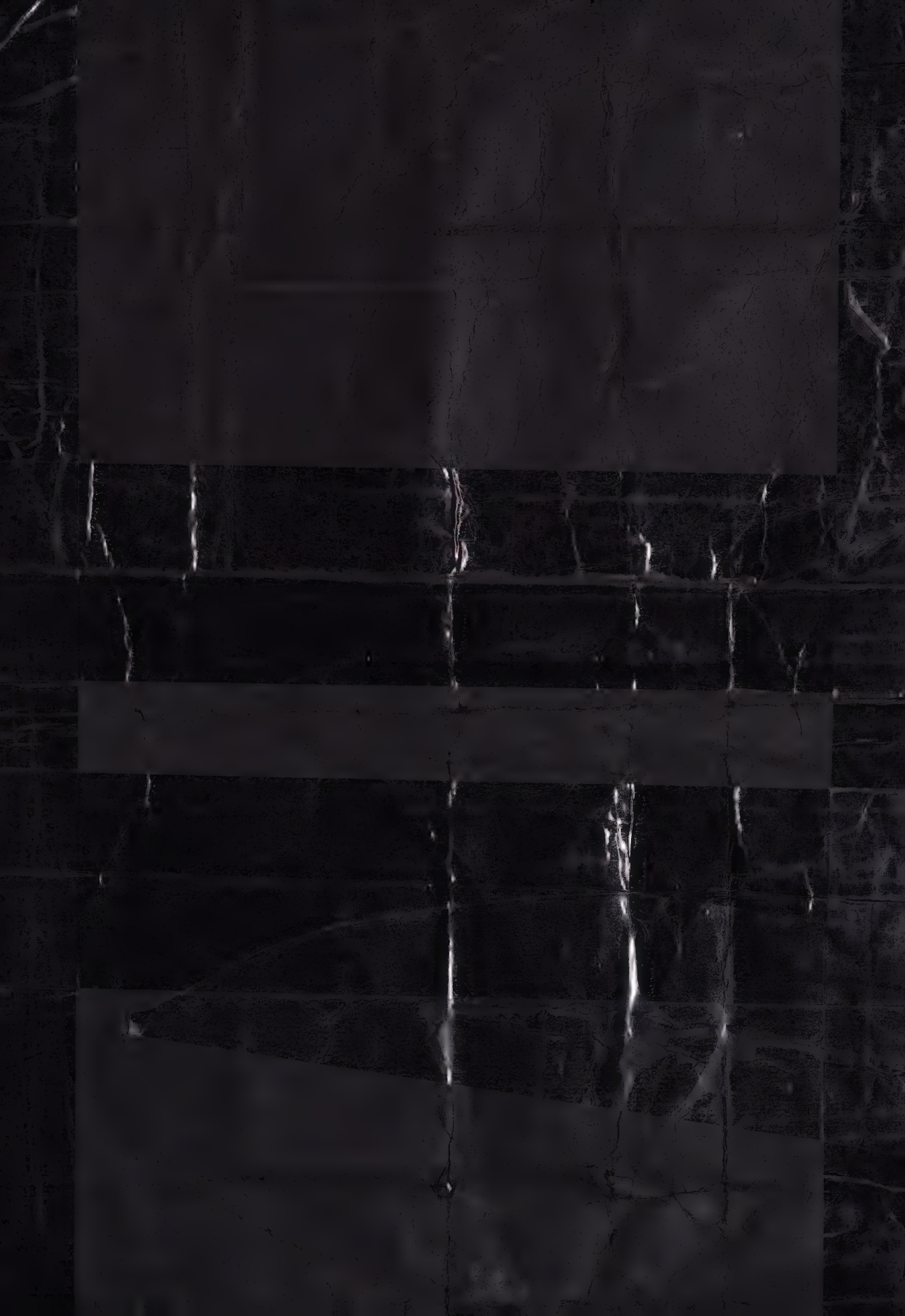


Figure 11.4 CPU p.c.b. A100, conductor side new version



	+5V	
HC32	14	7
HC132	14	7
HC138	16	8
HC244	20	10
HC573	20	10
HC574	20	10
HC4538	16	8


ADDRESS LATCH
DATA-BUS
RAM
ROM
DIGITAL SERVO IC
OUTPUT
INPUT
BEEPER
CHIP-SELECT
EVENT MARKER
JUMPER 6
JUMPER 5
JUMPER 4
JUMPER 7
ONLY IN NEW VERSIONS
SITUATION OLDER VERSIONS
SERVO KILL
PEN UP/DOWN
CHART CLOCK INT/EXT
FORWARD/REVERSE
PAGE/RETURN
START/STOP
PW POS
PW NEG
6MHz
CPU PCB A100



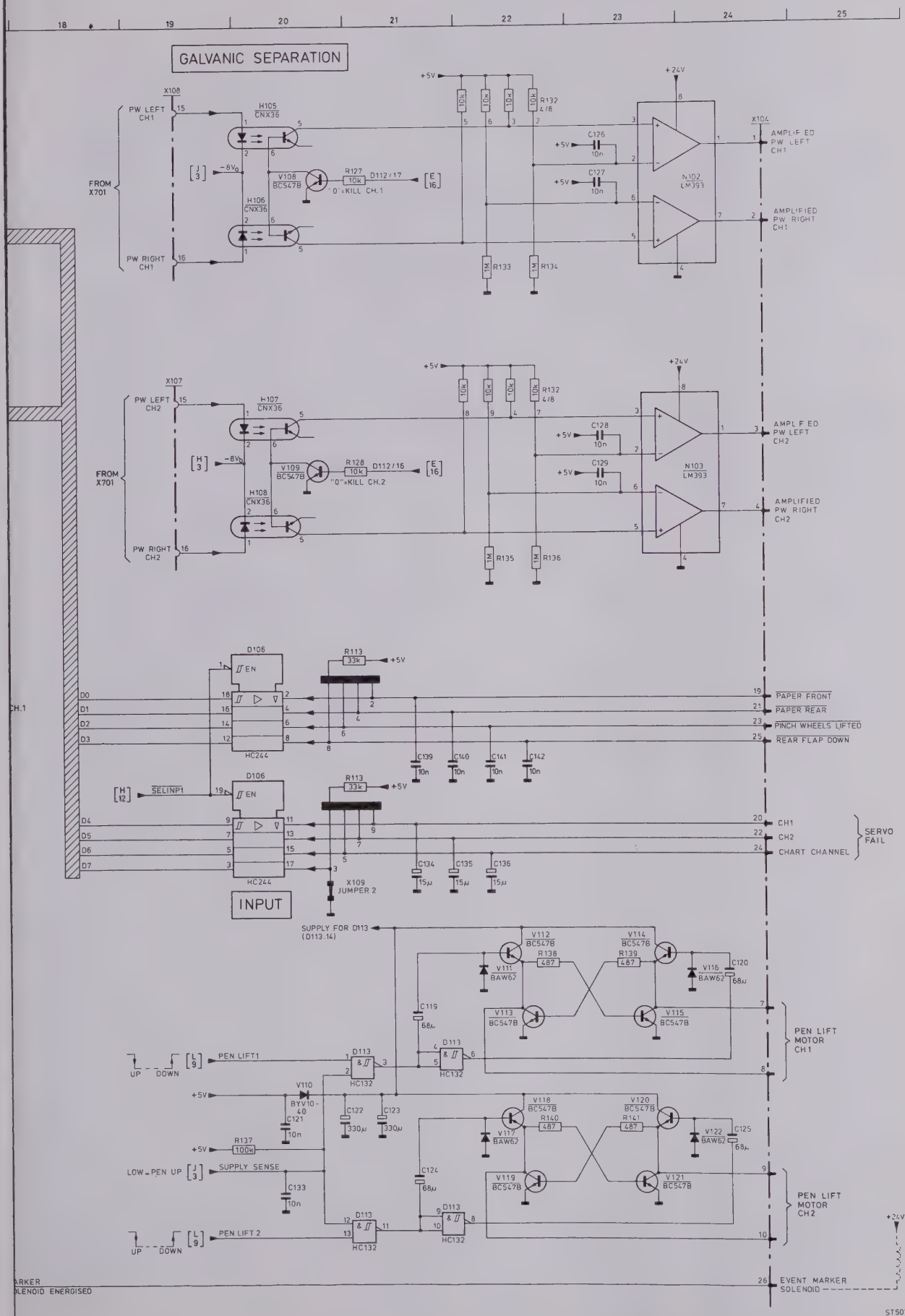
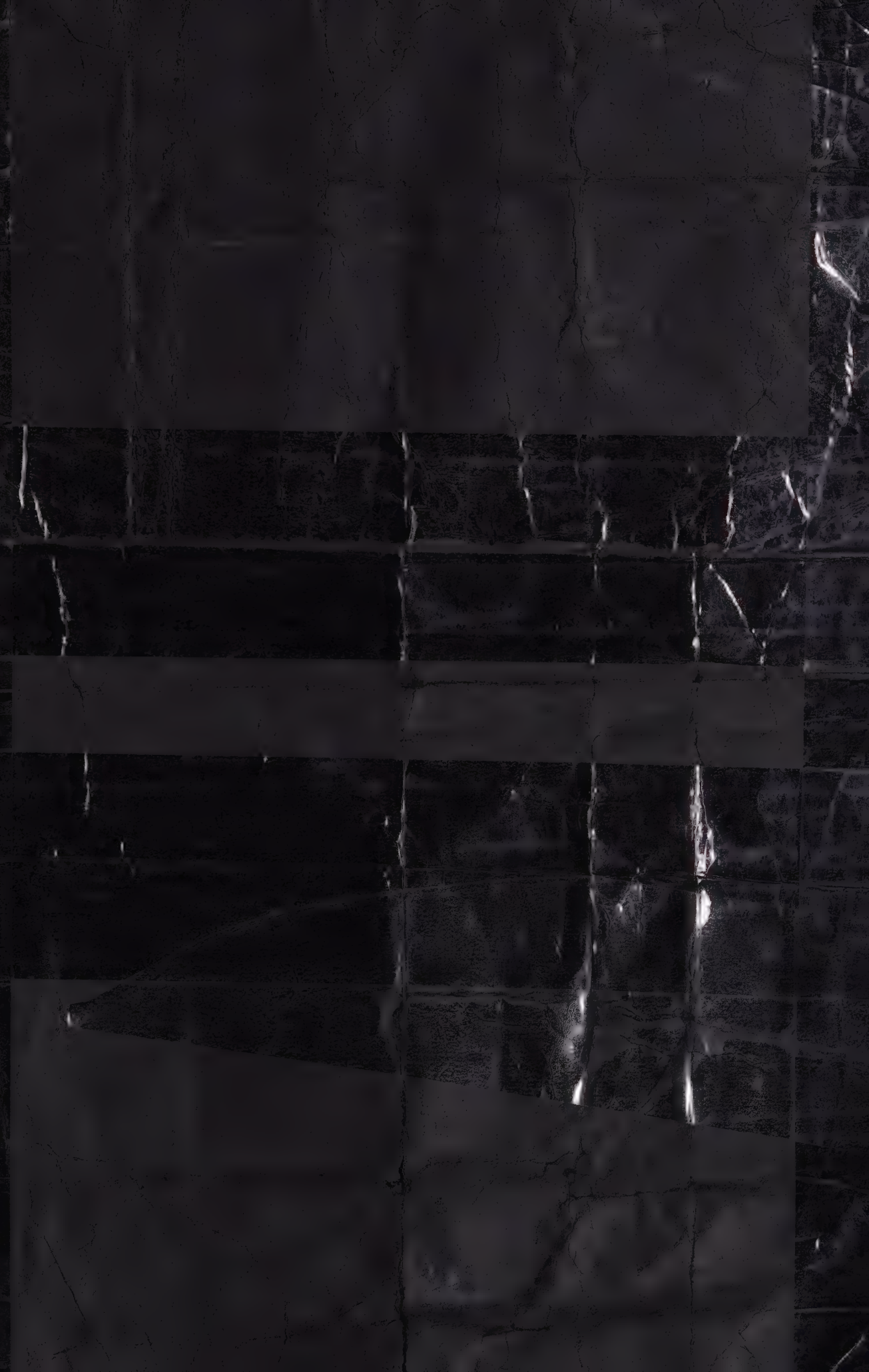


Figure 11.5 CPU p.c.b. A100



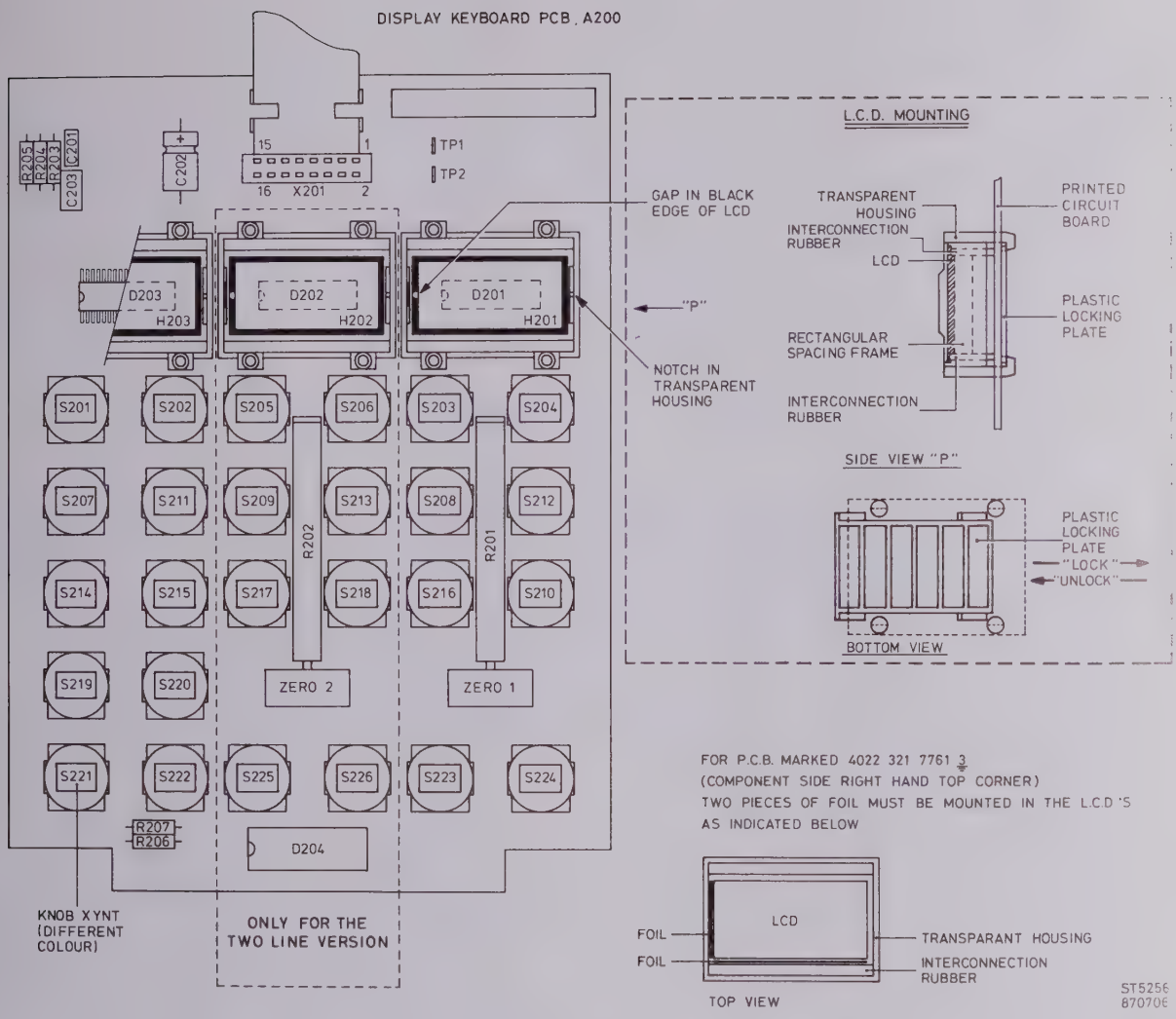


Figure 11.6 Display/keyboard p.c.b. A200, component side

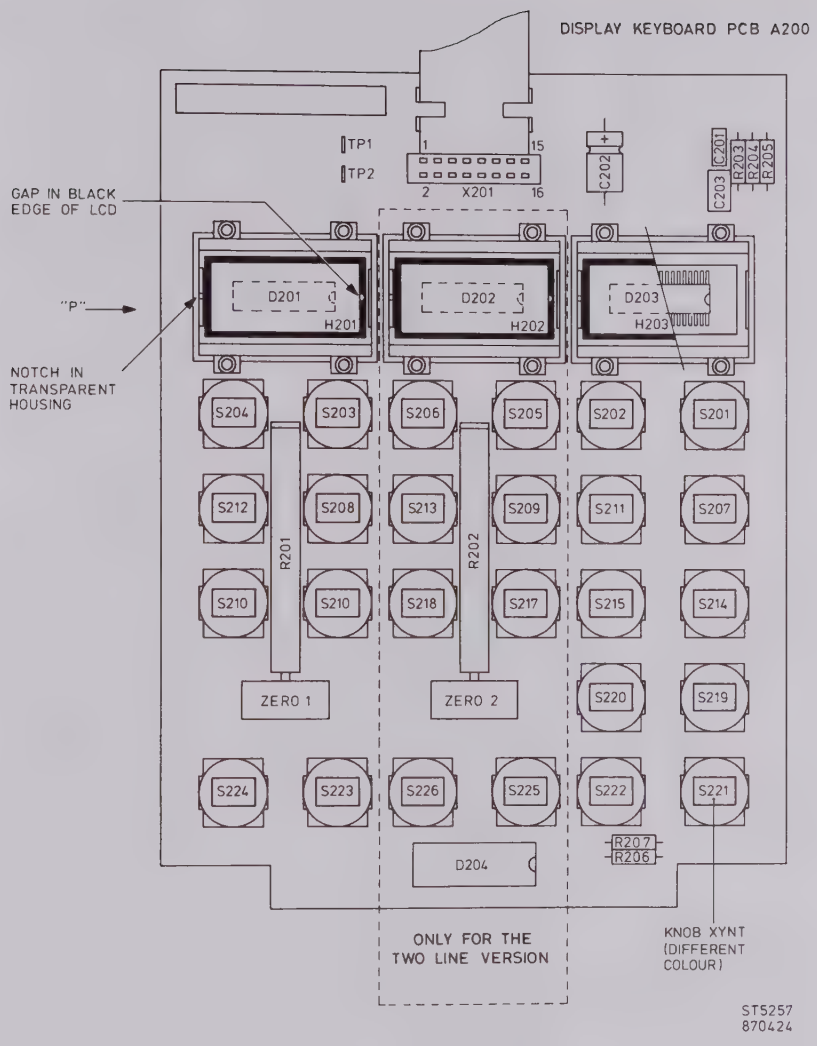


Figure 11.7 Display/keyboard p.c.b. A200, conductor side

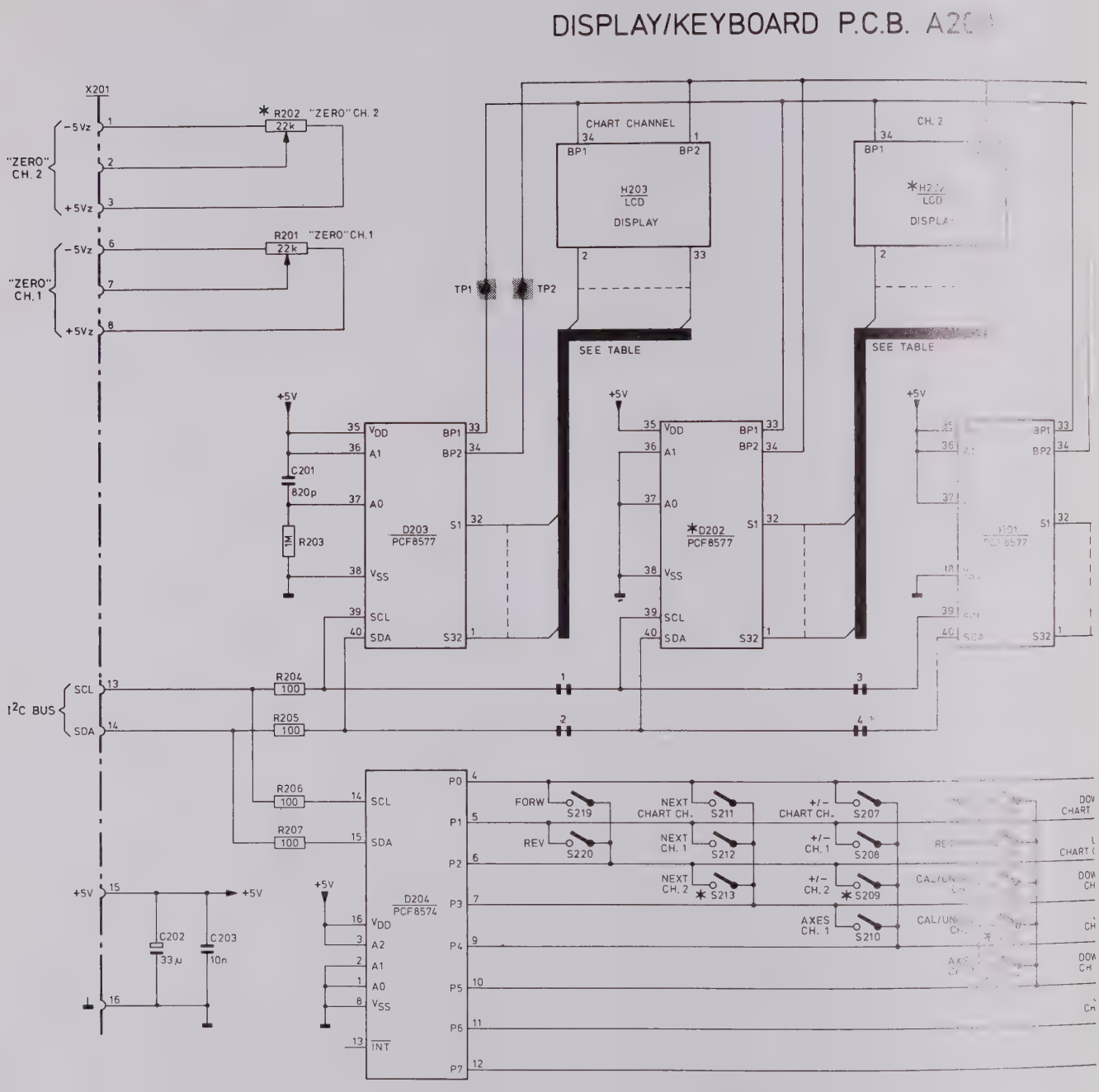
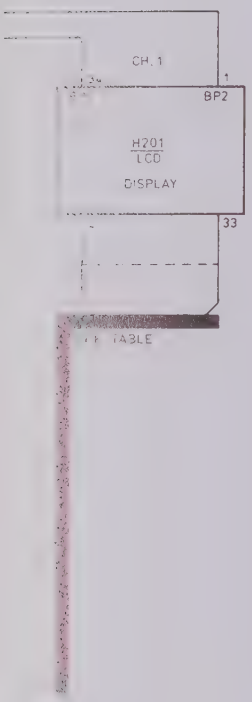
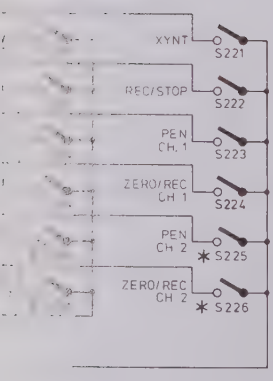


Figure 11.8 Display/keyboard p.c.b. A200



INTERCONNECTION TABLE	
PCF8577	DISPLAY
1	3
2	4
3	5
4	2
5	6
6	33
7	7
8	32
9	8
10	31
11	9
12	10
13	30
14	11
15	29
16	12
17	28
18	13
19	14
20	15
21	21
22	22
23	20
24	23
25	19
26	24
27	18
28	17
29	16
30	25
31	26
32	27



PARTS MARKED WITH A * ARE ONLY FOR THE 2 LINE VERSION

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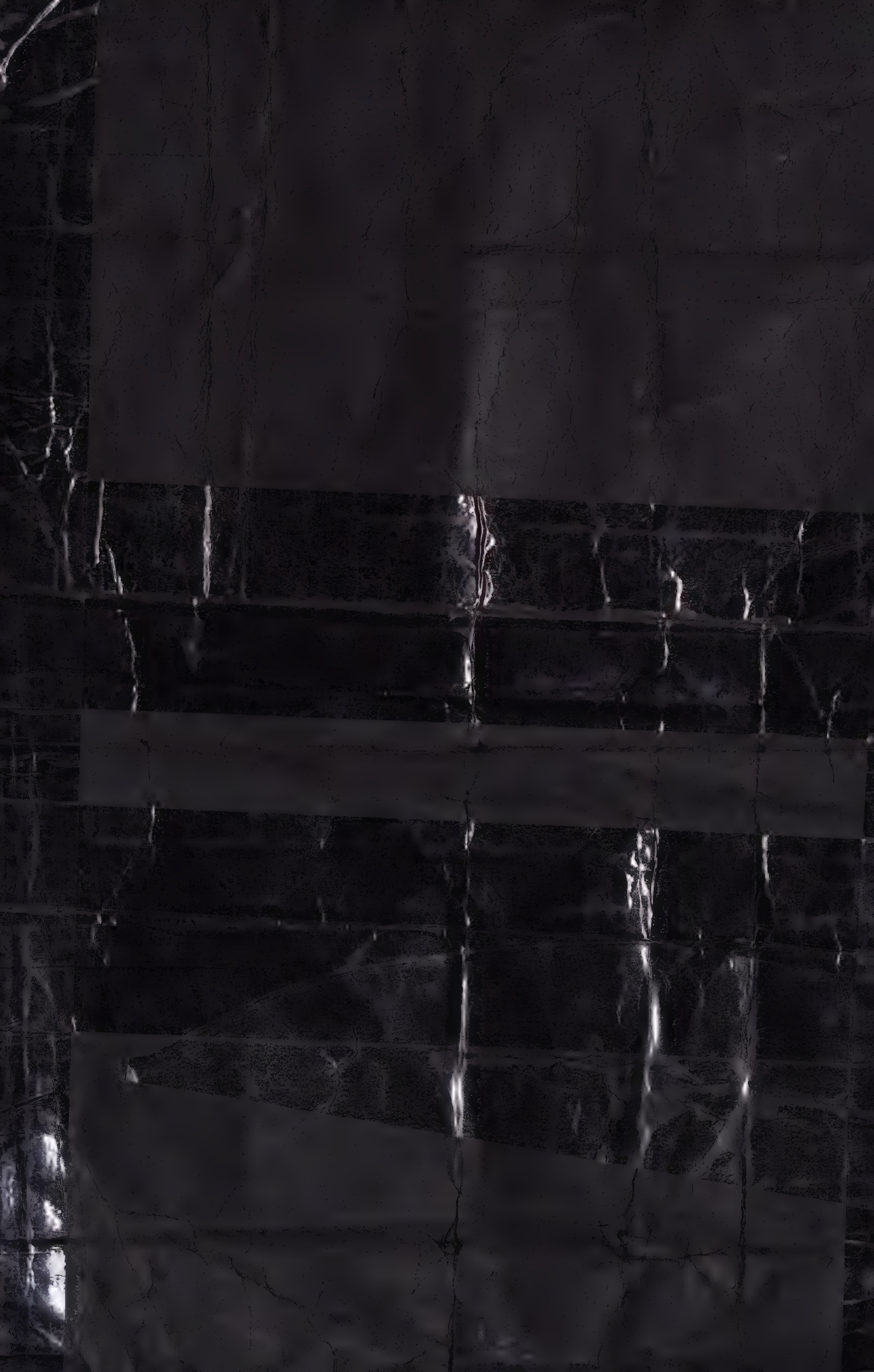


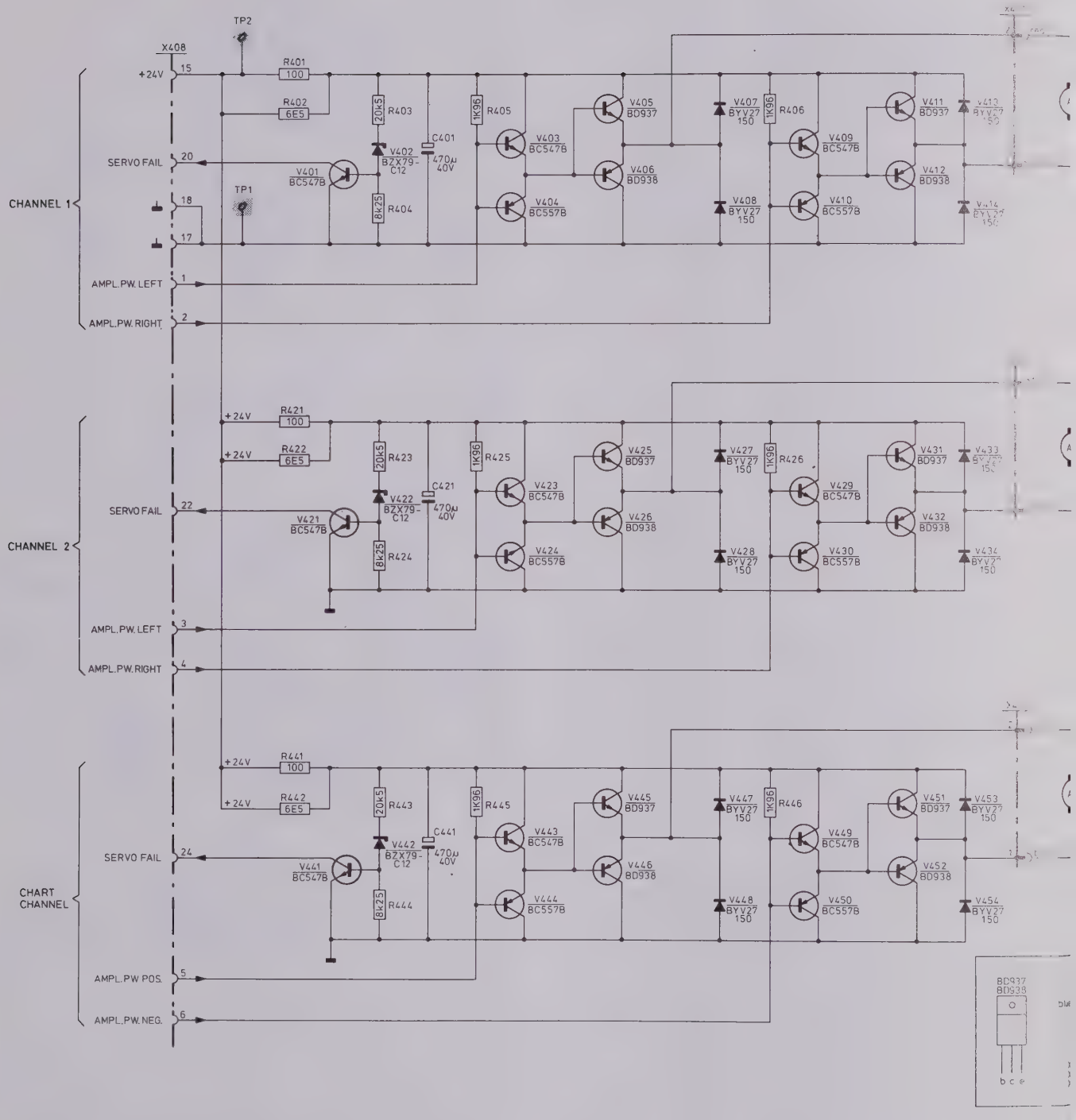
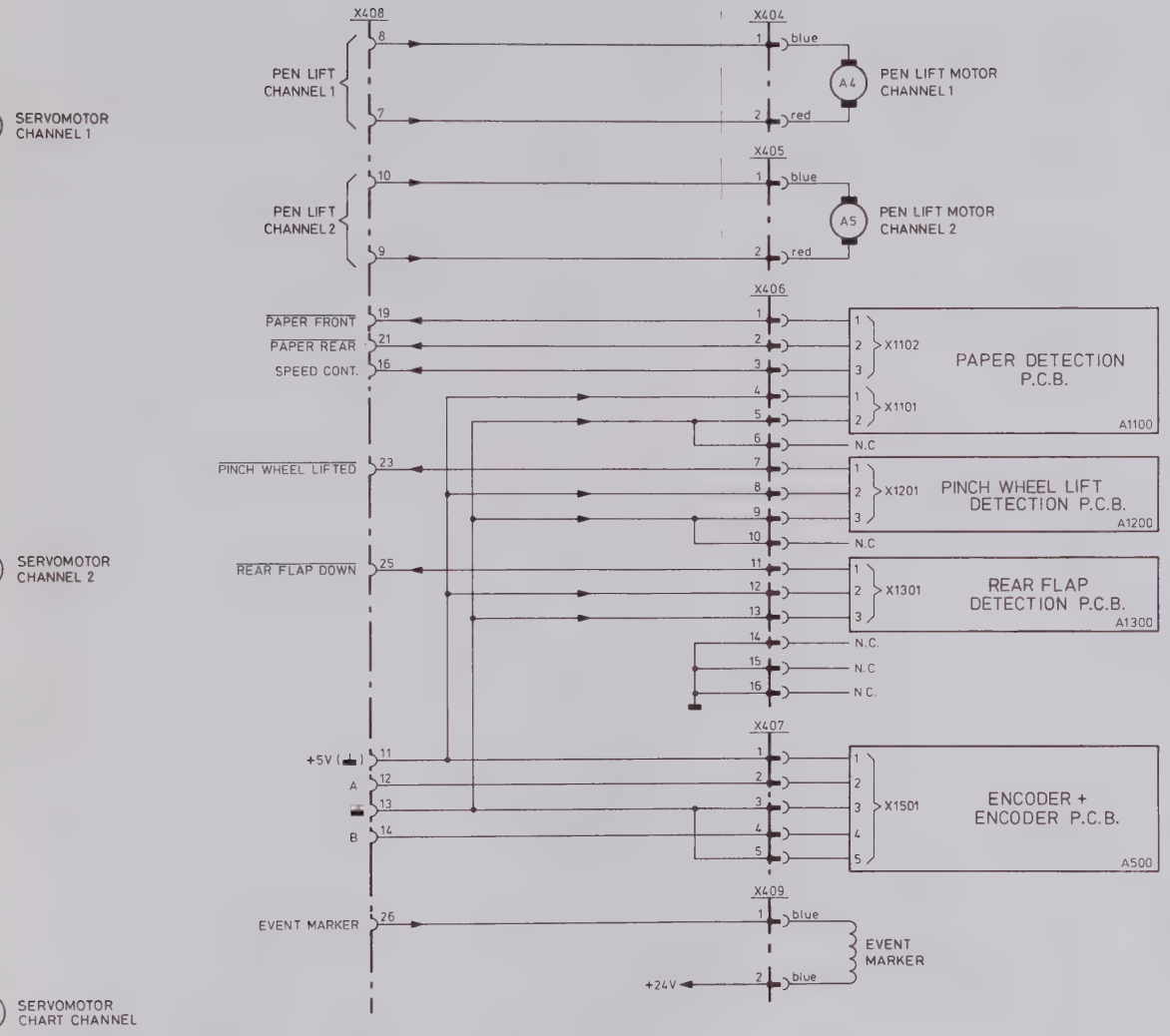


Figure 11.11 Servo End Stage p.c.b. A400


X408
X404
PEN LIFT CHANNEL 1
8
7
blue
red
A4
PEN LIFT MOTOR CHANNEL 1
SERVOMOTOR CHANNEL 1
X405
PEN LIFT CHANNEL 2
10
9
blue
red
A5
PEN LIFT MOTOR CHANNEL 2
X406
PAPER FRONT
PAPER REAR
SPEED CONT.
19
21
16
X1102
X1101
PAPER DETECTION P.C.B.
A1100
N.C
PINCH WHEEL LIFTED
23
X1201
PINCH WHEEL LIFT DETECTION P.C.B.
A1200
N.C
SERVOMOTOR CHANNEL 2
REAR FLAP DOWN
25
X1301
REAR FLAP DETECTION P.C.B.
A1300
N.C.
N.C
N.C.
X407
+5V
A
B
11
12
13
14
X1501
ENCODER + ENCODER P.C.B.
A500
X409
EVENT MARKER
26
blue
blue
EVENT MARKER
+24V
SERVOMOTOR CHART CHANNEL
ST5073
880415

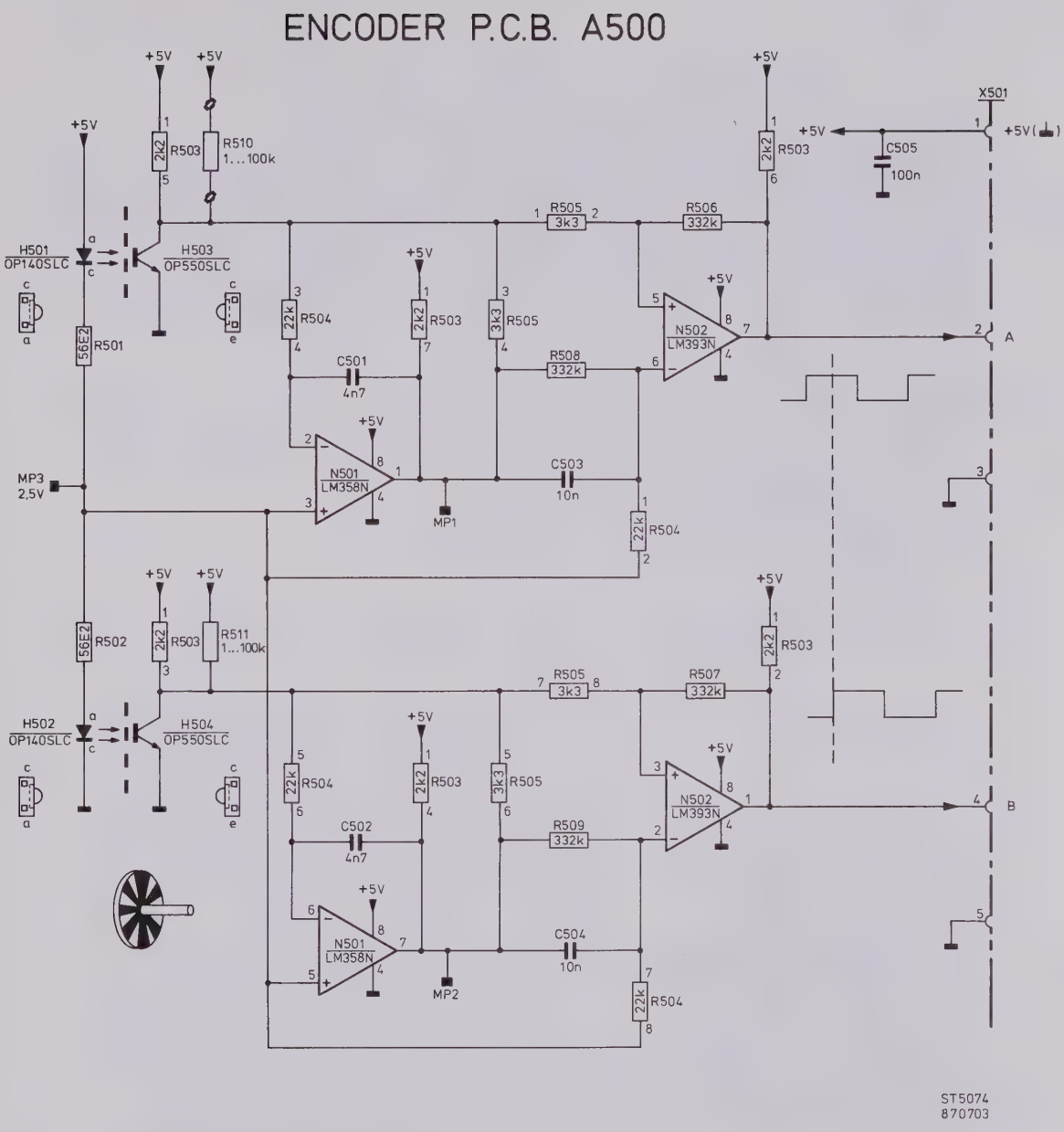


Figure 11.17 Encoder p.c.b. A500, no. 4022 321 77592

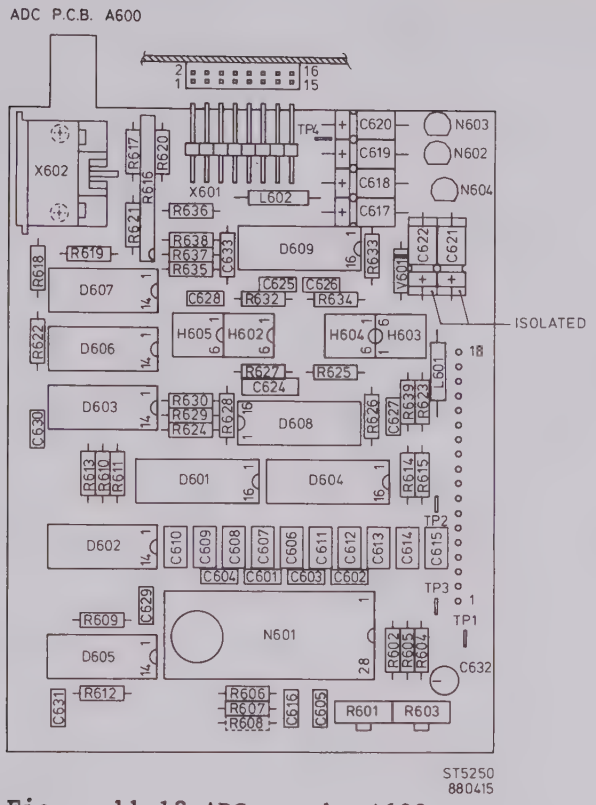


Figure 11.18 ADC p.c.b. A600, component side

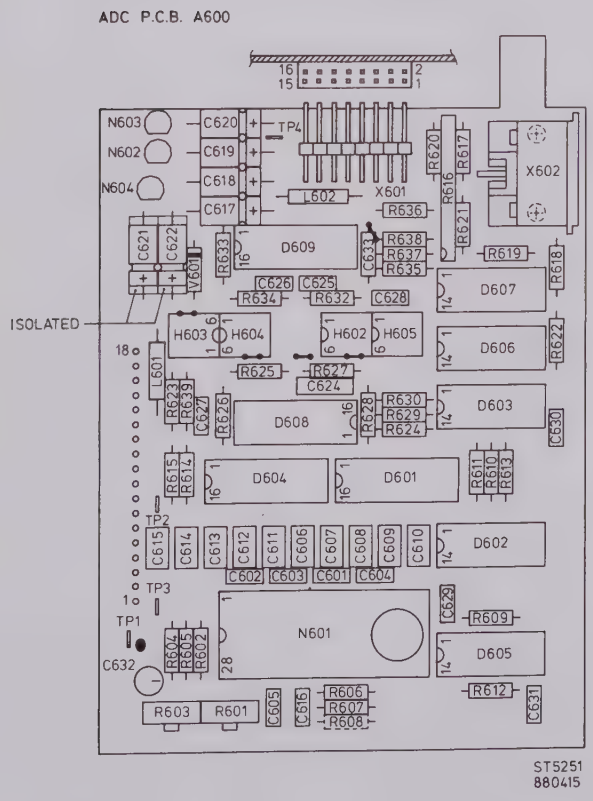
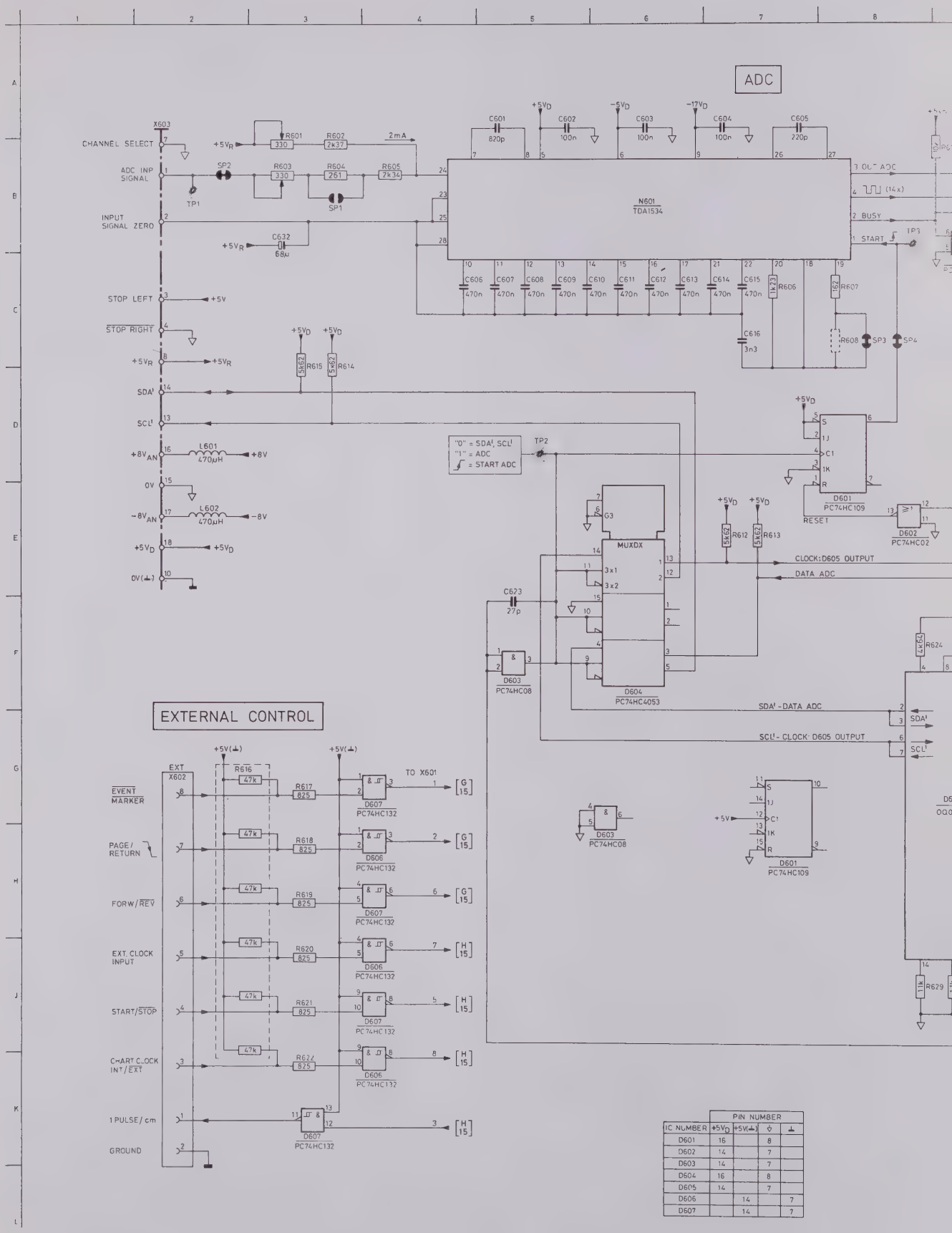


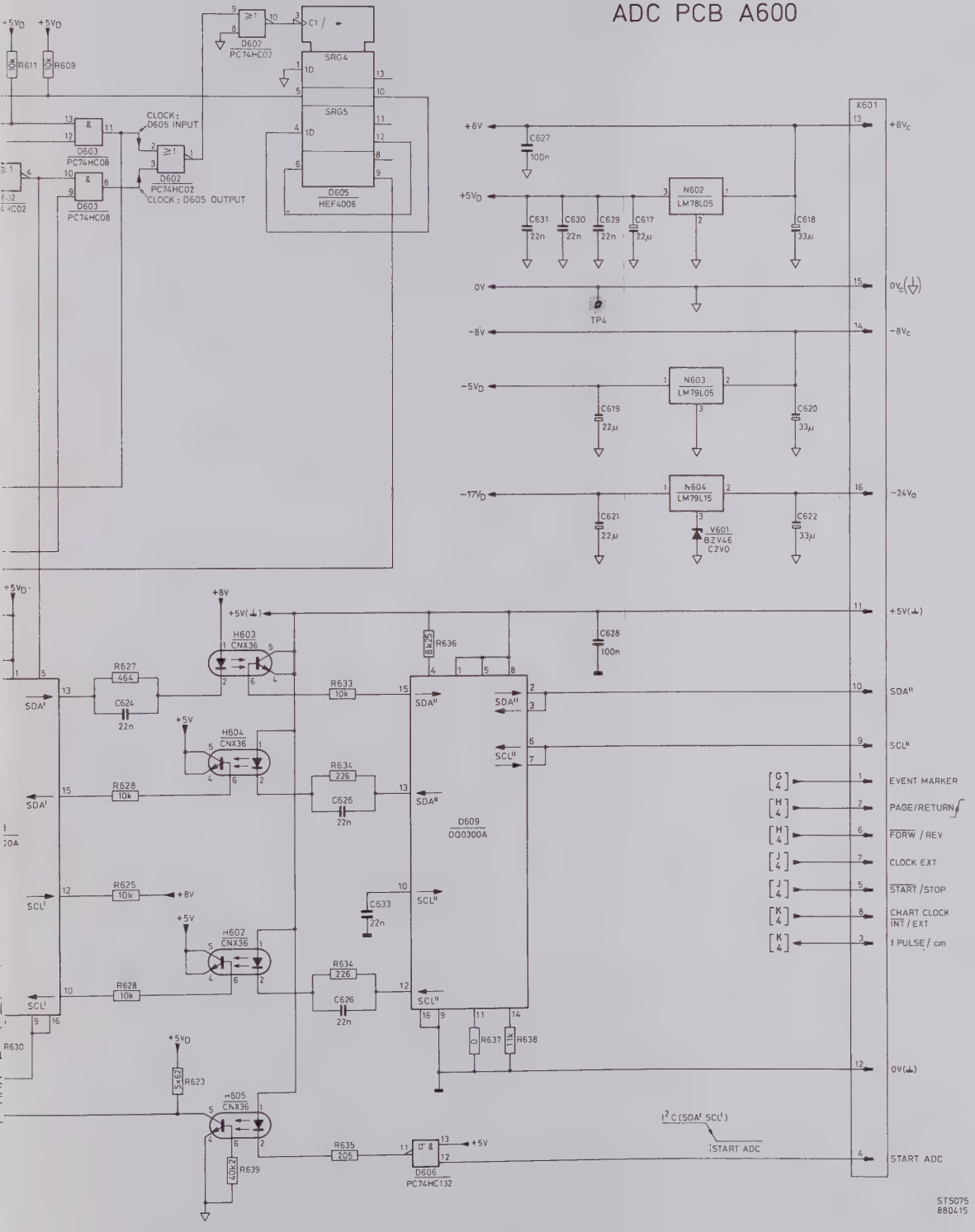
Figure 11.19 ADC p.c.b. A600, conductor side



IC NUMBER	PIN NUMBER +5V$_D$	+5V(⊥)	⏚	⊥
D601	16		8	
D602	14		7	
D603	14		7	
D604	16		8	
D605	14		7	
D606		14		7
D607		14		7

Figure 11.20 ADC p.c.b. A600

ADC PCB A600



GALVANIC SEPARATION

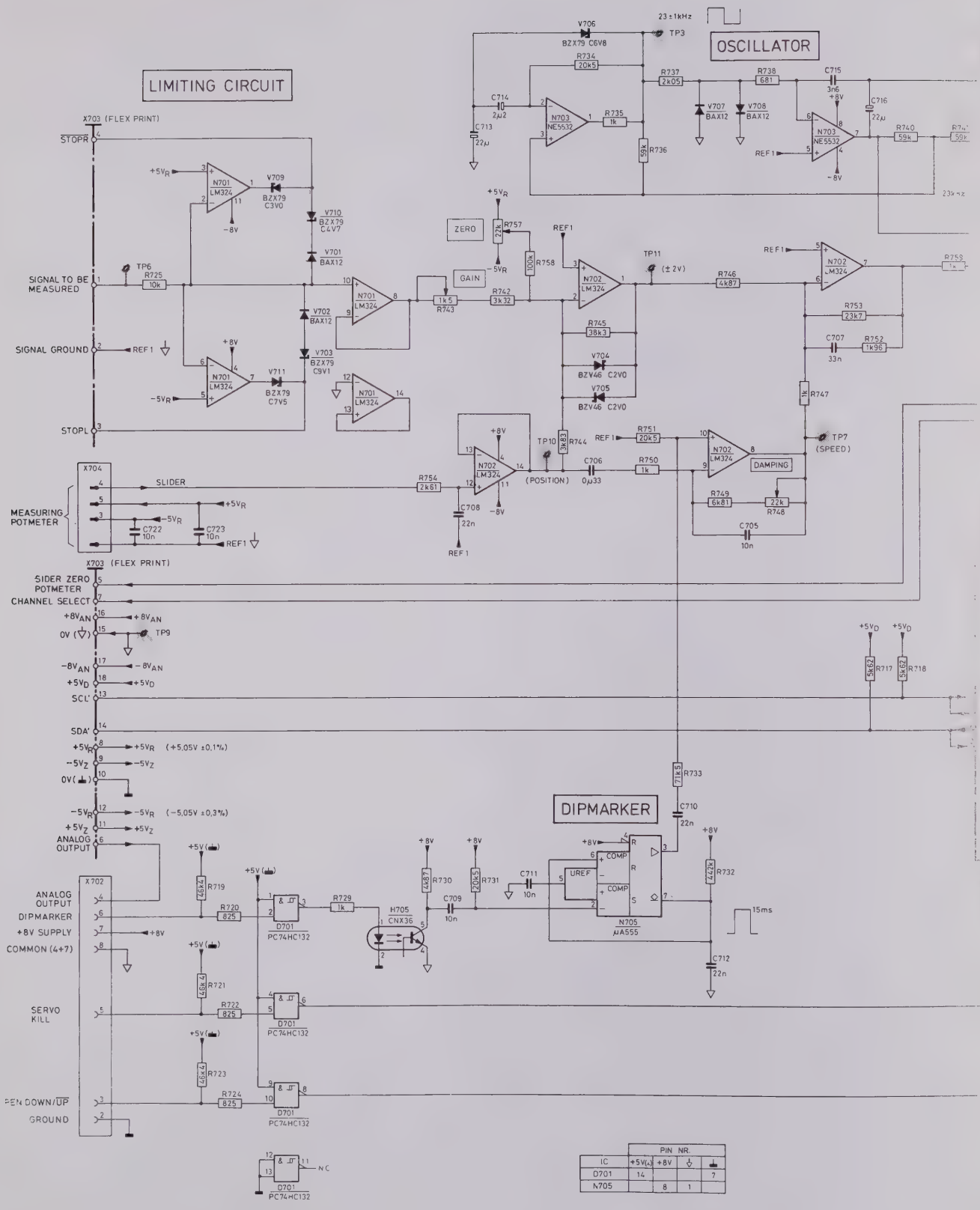
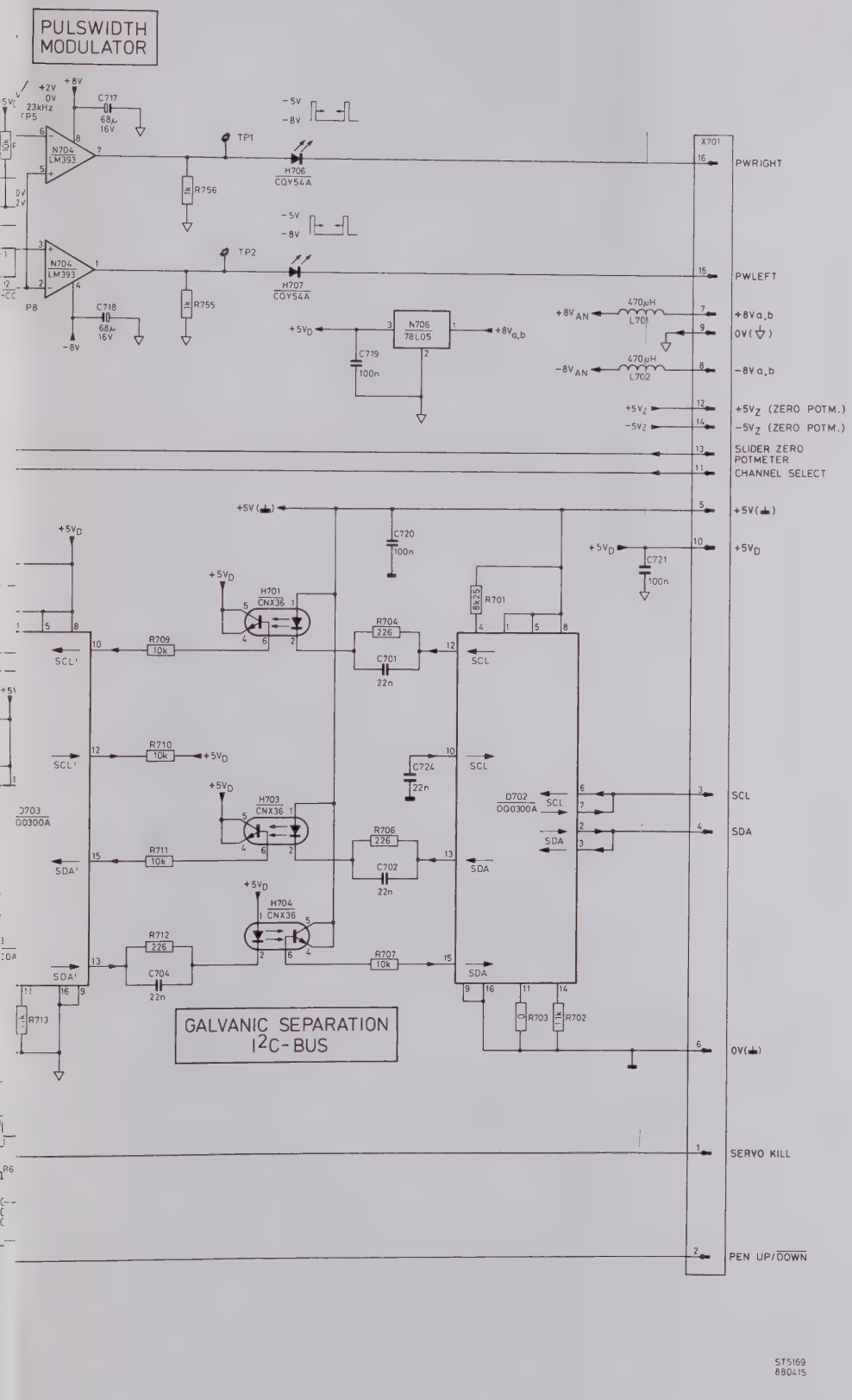


Figure 11.23 Servo p.c.b. A700

SERVO PCB A700



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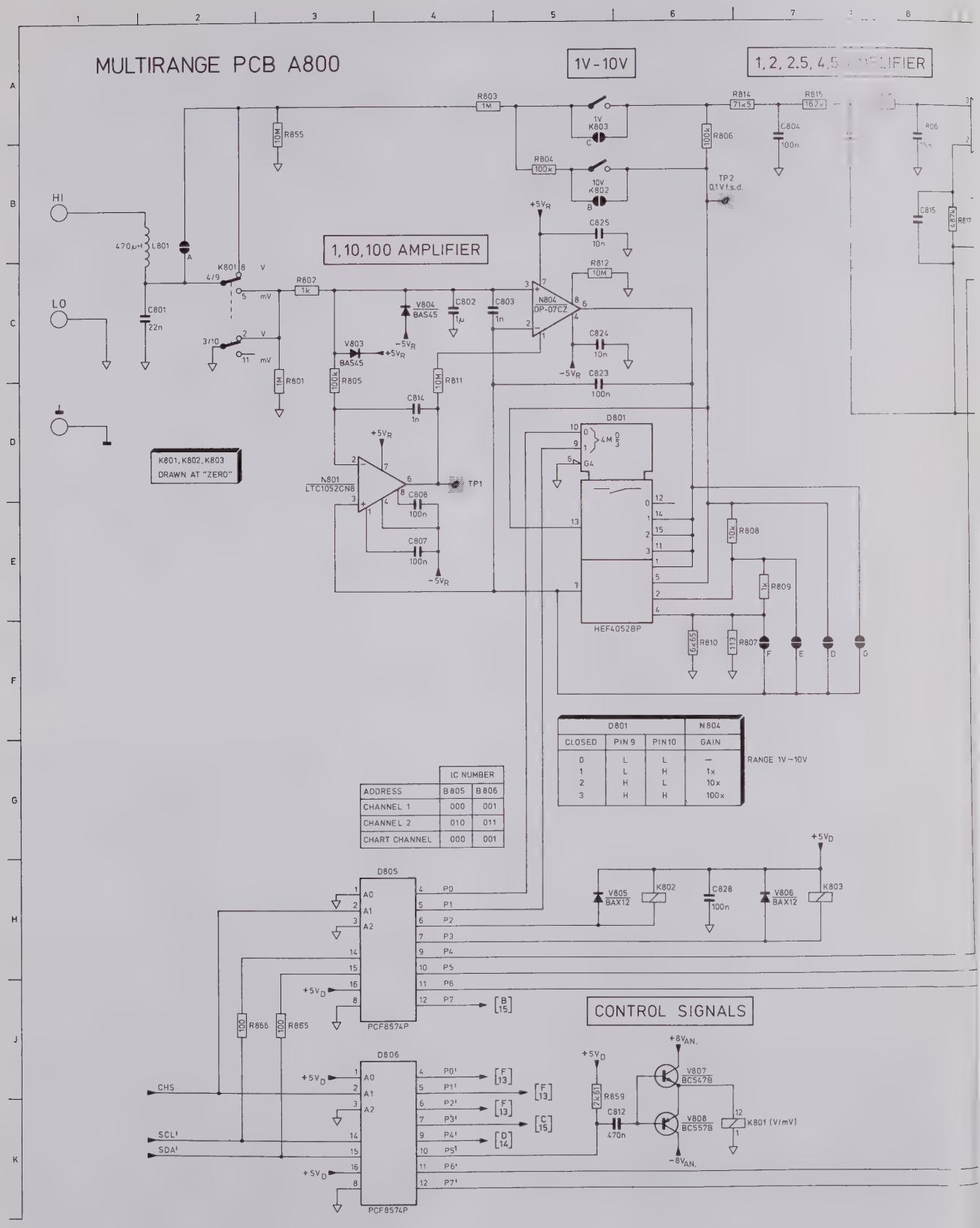
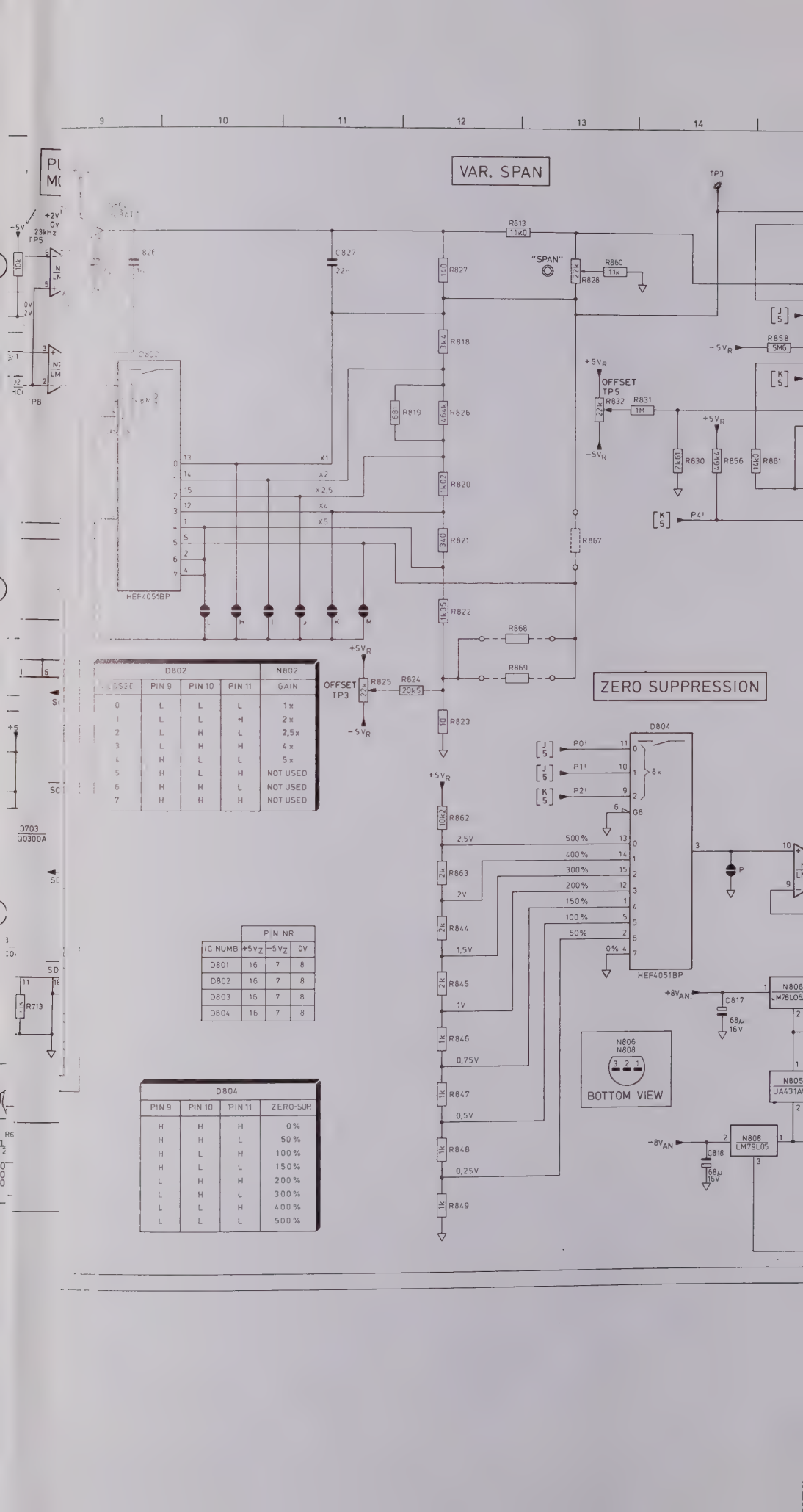

MULTIRANGE PCB A800
1V-10V
1,2,2.5,4,5 AMPLIFIER
1,10,100 AMPLIFIER
HI
LO
470µH L801
C801 22n
K801 8 V 4/9 5 mV
3/10 2 V 11 mV
R801 1M
R802 1k
R803 1M
R804 100k
R805 100k
R806 100k
R811 10M
R812 10M
R814 71k5
R815 162k
R855 10M
1V K803
10V K802
TP2 0.1V f.s.d.
C804 100n
C805 2.87n
R817
C802 1µ
C803 1n
C814 1n
C823 100n
C824 10n
C825 10n
V803 BAS45
V804 BAS45
N804 OP-07CZ
N801 LTC1052CN8
C807 100n
C808 100n
TP1
+5V_R
-5V_R
K801, K802, K803 DRAWN AT "ZERO"
D801
4M 0/3
HEF4052BP
R808 10k
R809 1k
R810 6k65
R807 1k13
F
E
D
G
D801 N804
CLOSED PIN 9 PIN 10 GAIN
0 L L –
1 L H 1x
2 H L 10x
3 H H 100x
RANGE 1V–10V
IC NUMBER
ADDRESS B805 B806
CHANNEL 1 000 001
CHANNEL 2 010 011
CHART CHANNEL 000 001
D805
PCF8574P
A0 A1 A2
P0 P1 P2 P3 P4 P5 P6 P7
+5V_D
R865 100
R866 100
V805 BAX12
V806 BAX12
K802
K803
C828 100n
CONTROL SIGNALS
D806
PCF8574P
CHS
SCL'
SDA'
P0' P1' P2' P3' P4' P5' P6' P7'
+8V_AN.
-8V_AN.
V807 BC547B
V808 BC557B
R859 2k65
C812 470n
K801 (V/mV)



D802				N802
BCD	PIN 9	PIN 10	PIN 11	GAIN
0	L	L	L	1x
1	L	L	H	2x
2	L	H	L	2,5x
3	L	H	H	4x
4	H	L	L	5x
5	H	L	H	NOT USED
6	H	H	L	NOT USED
7	H	H	H	NOT USED

	PIN NR		
IC NUMB	+5V_Z	-5V_Z	0V
D801	16	7	8
D802	16	7	8
D803	16	7	8
D804	16	7	8

D804			
PIN 9	PIN 10	PIN 11	ZERO-SUP
H	H	H	0%
H	H	L	50%
H	L	H	100%
H	L	L	150%
L	H	H	200%
L	H	L	300%
L	L	H	400%
L	L	L	500%

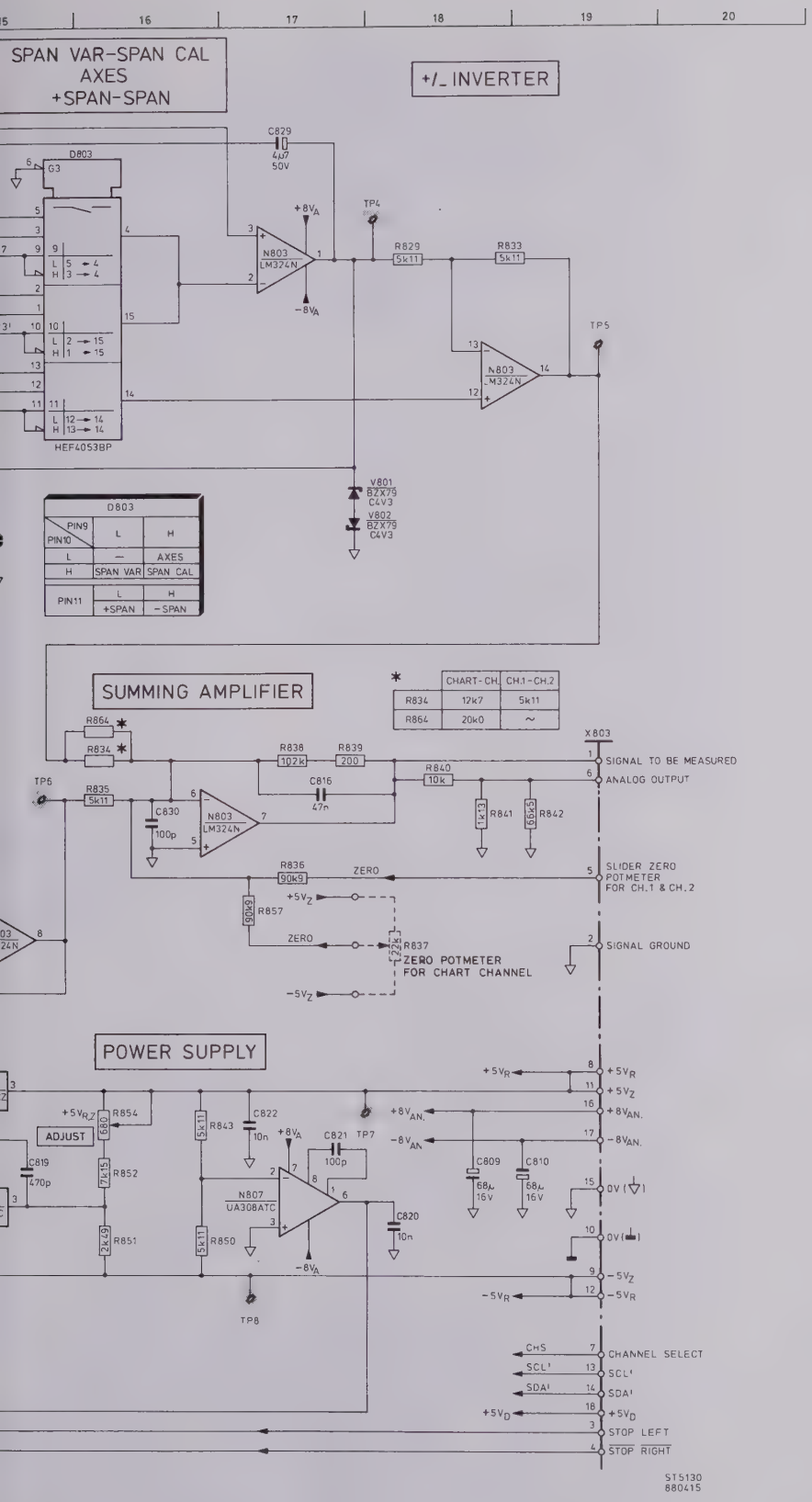


Figure 11.26 Multirange p.c.b. A800

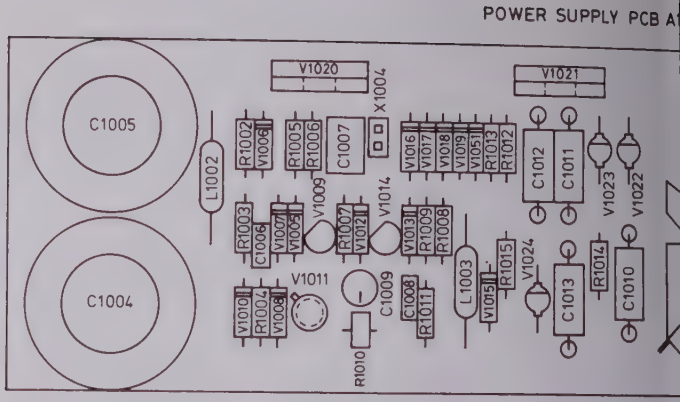


Figure 11.27 Power supply p.c.b. A1000, compo
without extra -24 Vdc supply

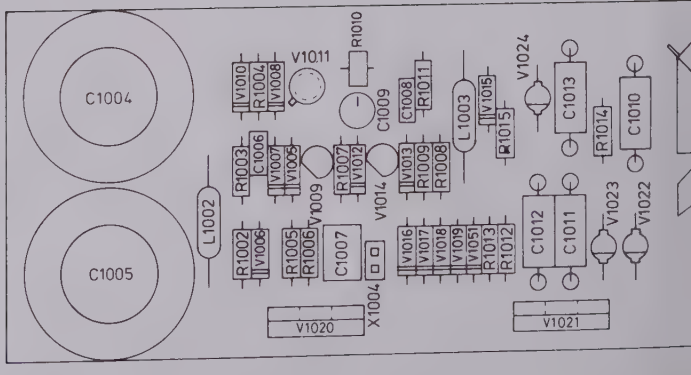
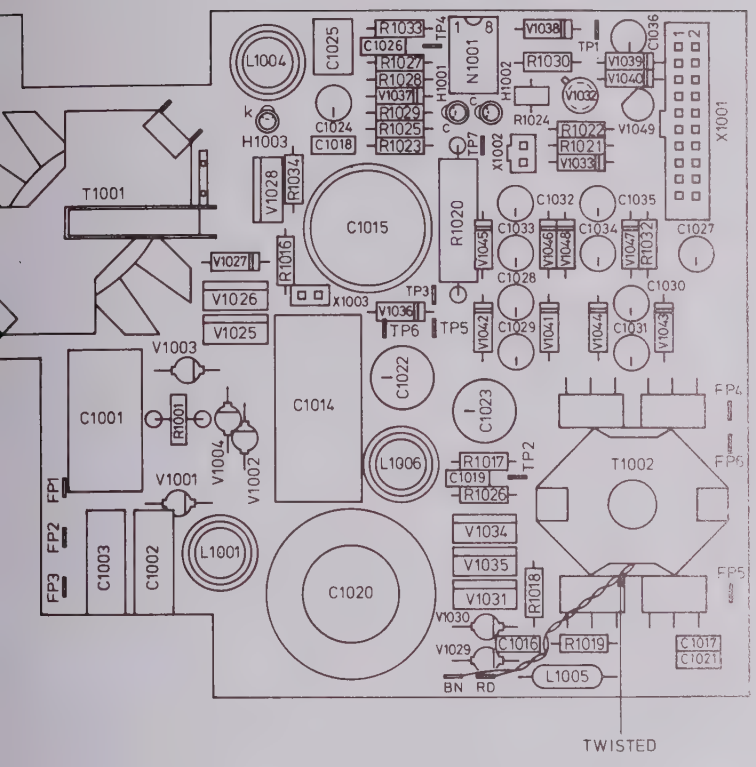


Figure 11.28 Power supply p.c.b. A1000, condu
without extra -24 Vdc supply

00



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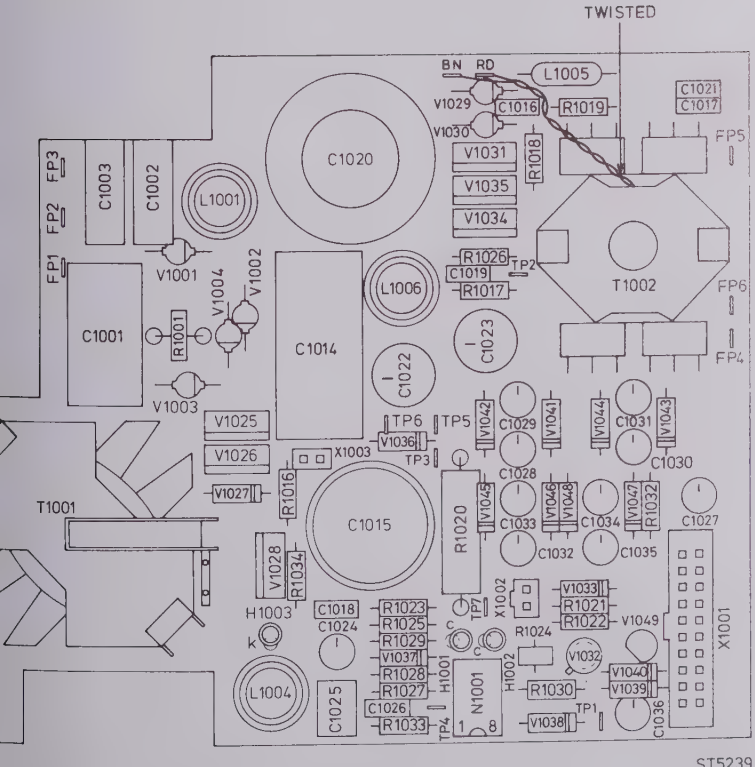
ent side

LY PCB A1000



ST5239
870424

tor side

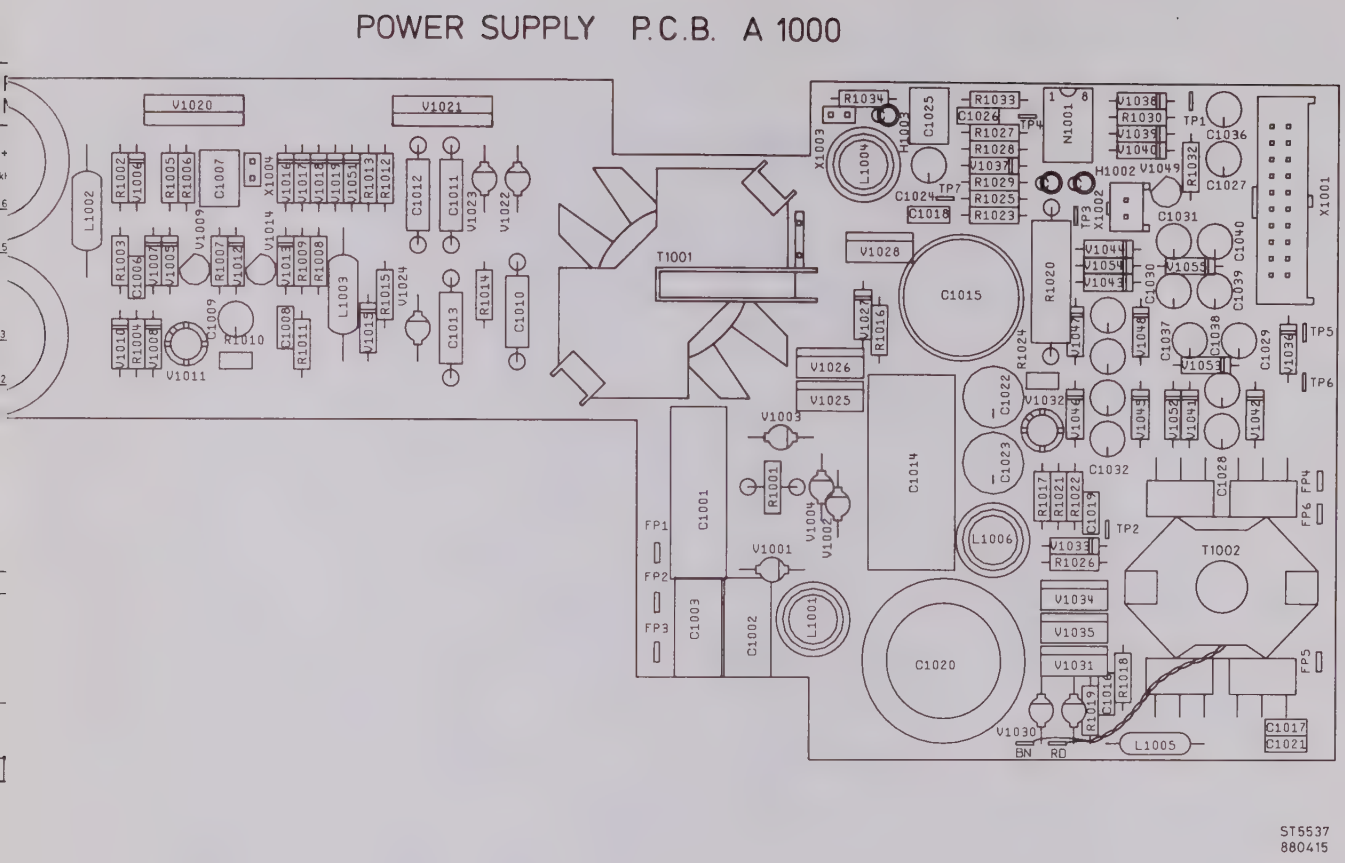


Figure 11.29 Power supply p.c.b. A1000, component side (new version)

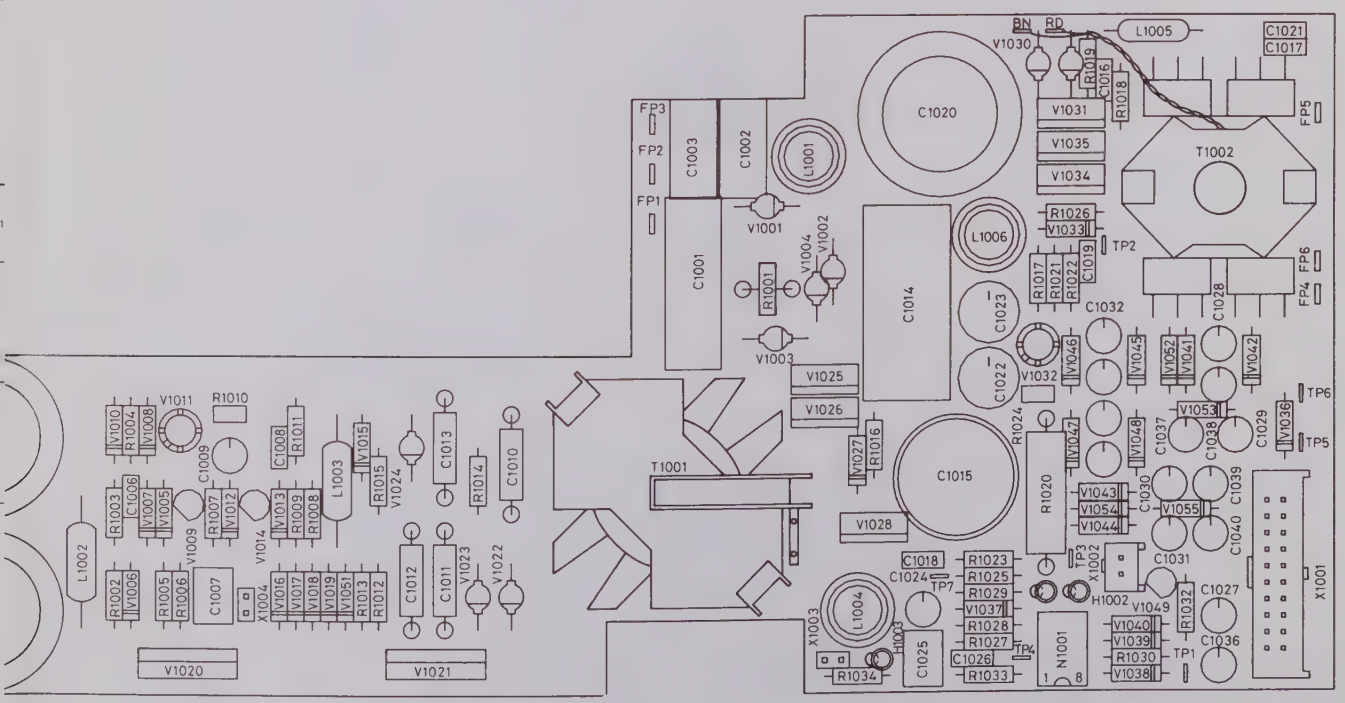


Figure 11.30 Power supply p.c.b. A1000, conductor side (new version)

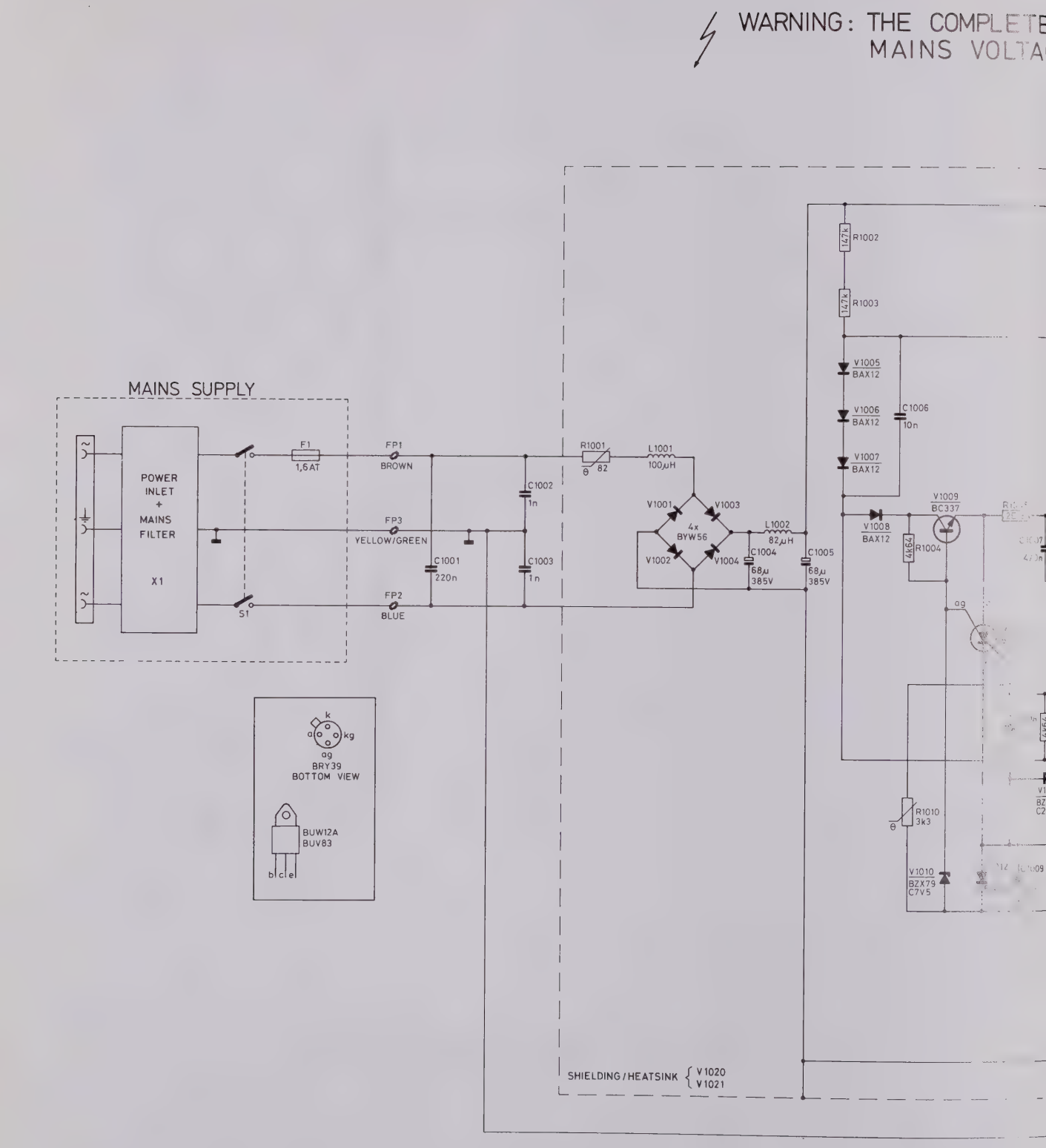
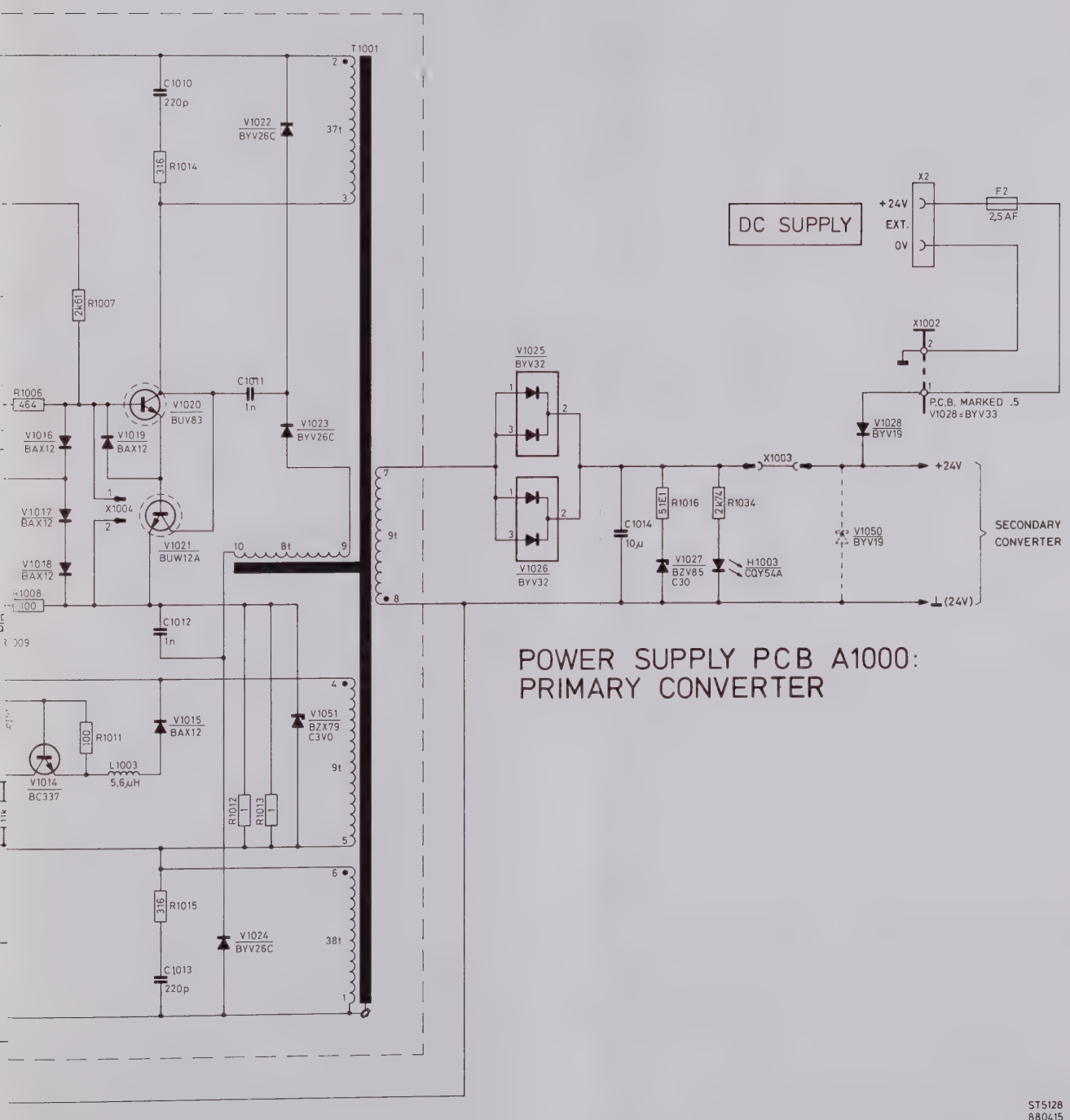


Figure 11.31 Power supply p.c.b. A1000, primary converter

CIRCUIT IS AT
GE LEVEL



POWER SUPPLY PCB A1000:
PRIMARY CONVERTER

ST5128
880415

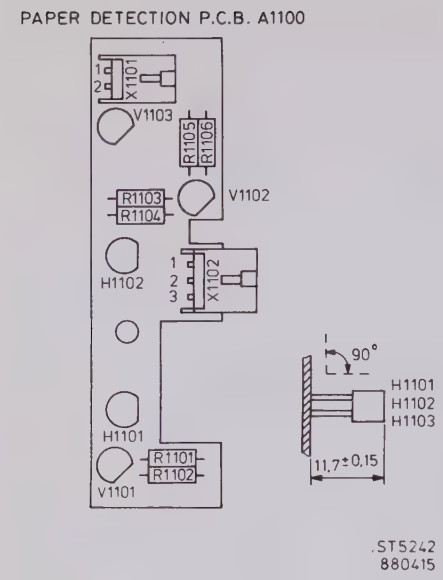


Figure 11.33 Paper detection p.c.b. A1100, component side

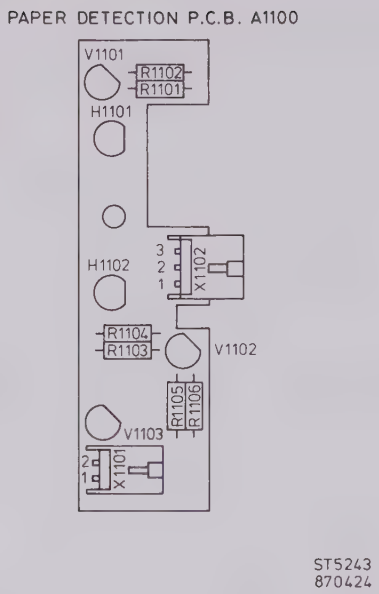


Figure 11.34 Paper detect... p.c.b. A1... conductor

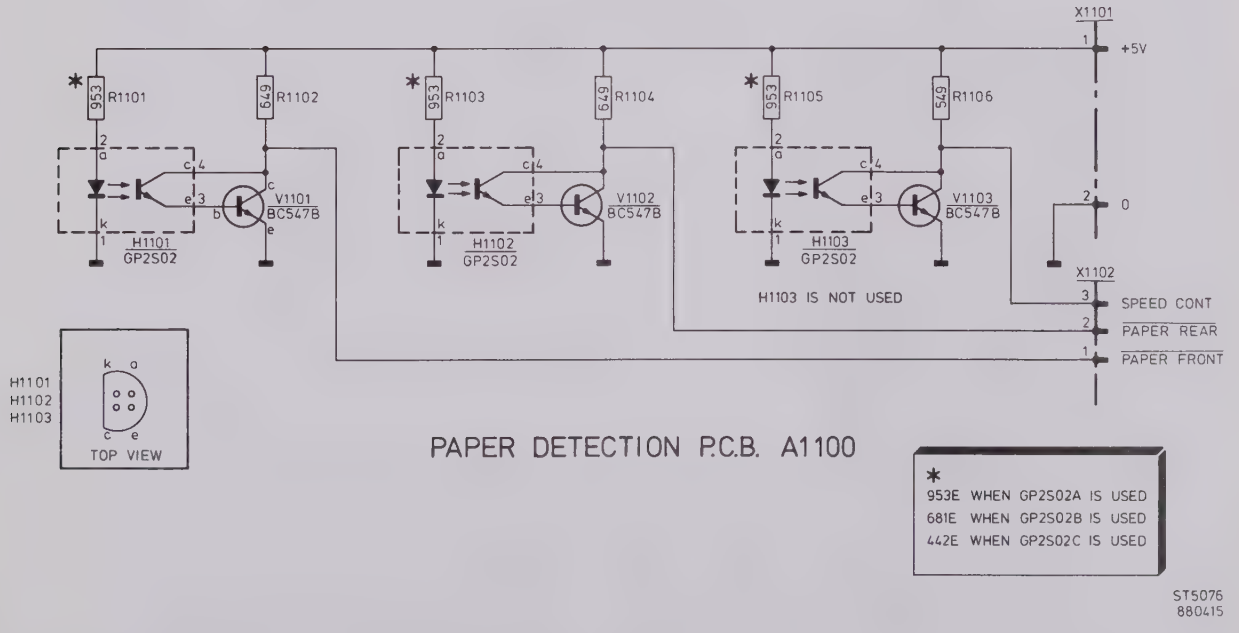


Figure 11.35 Paper detection p.c.b. A1100

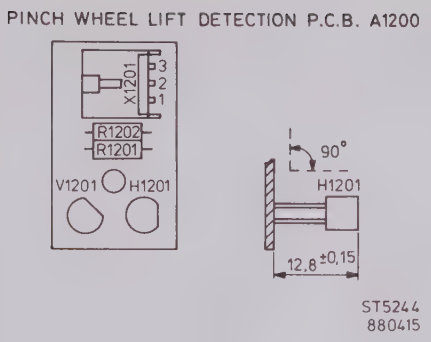


Figure 11.36 Pinch wheel lift detection p.c.b. A1200, component side

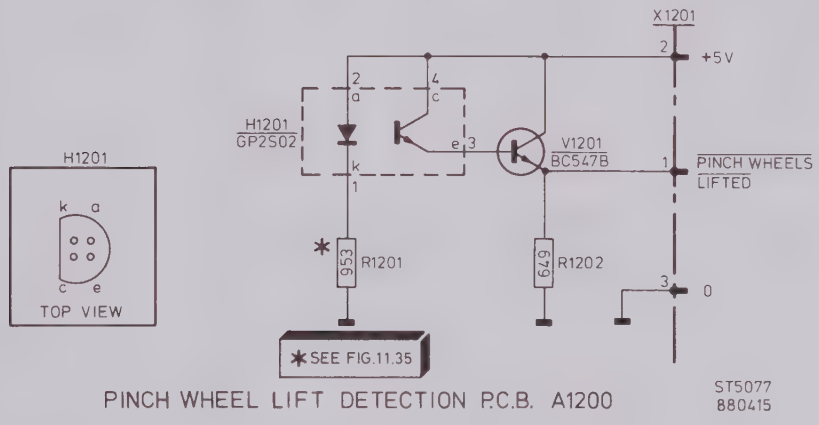


Figure 11.37 Pinch wheel lift detection p.c.b. A1200

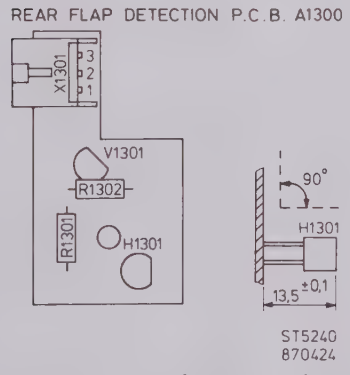


Figure 11.38 Rear flap detection p.c.b. A1300, component side

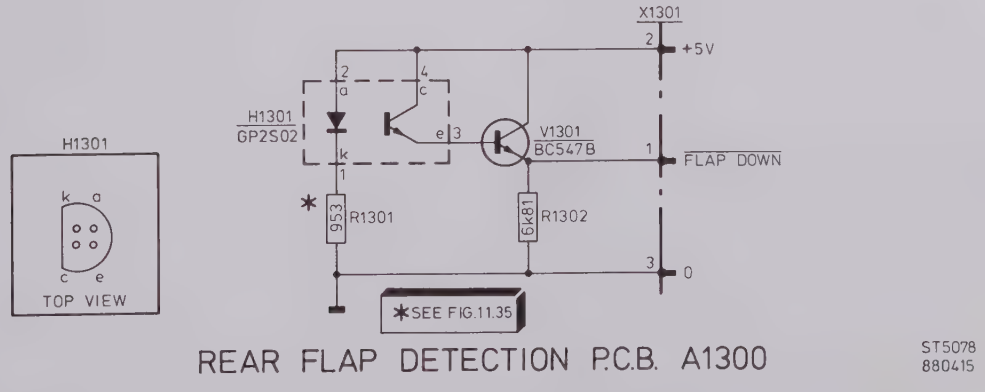


Figure 11.39 Rear flap detection p.c.b. A1300

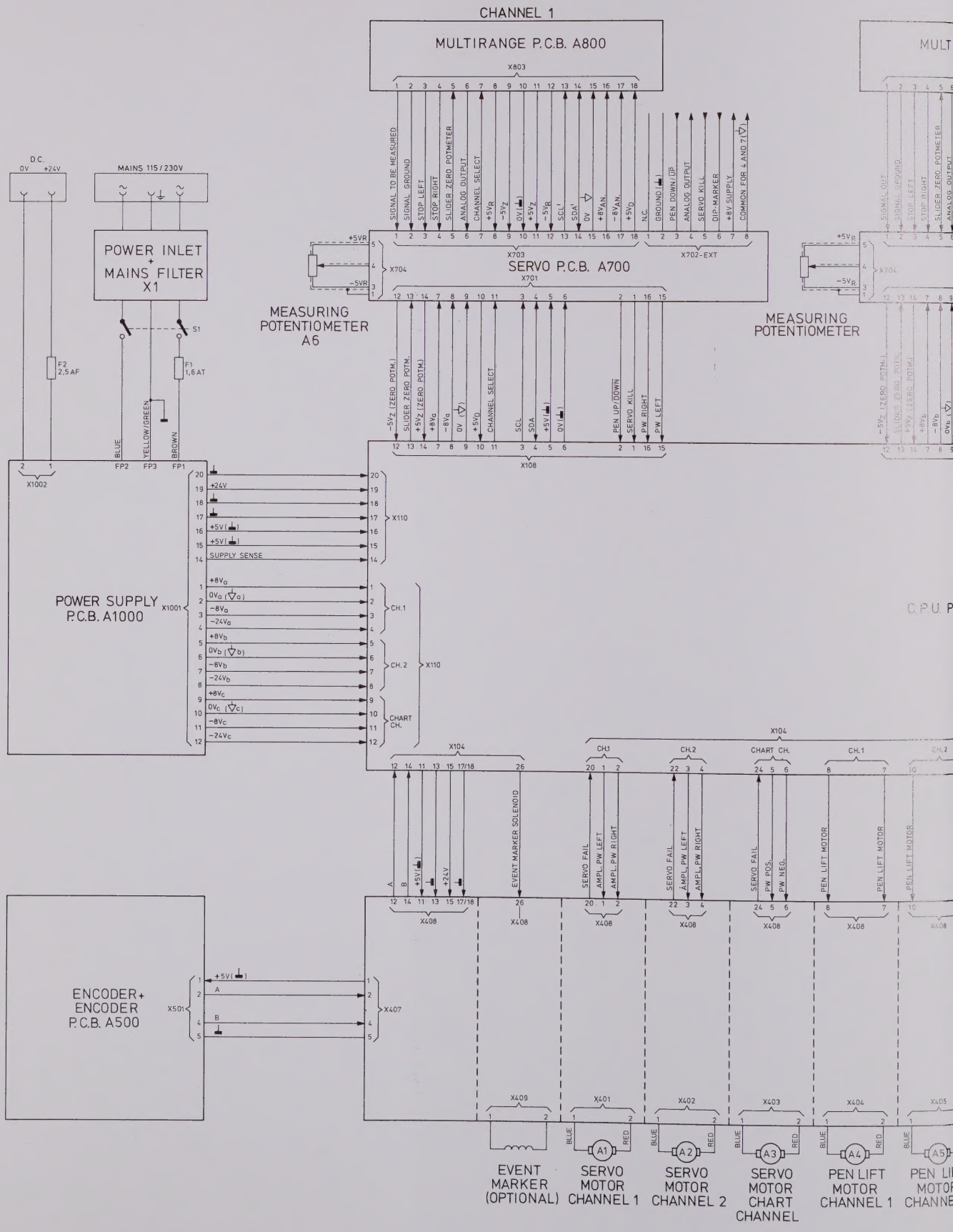
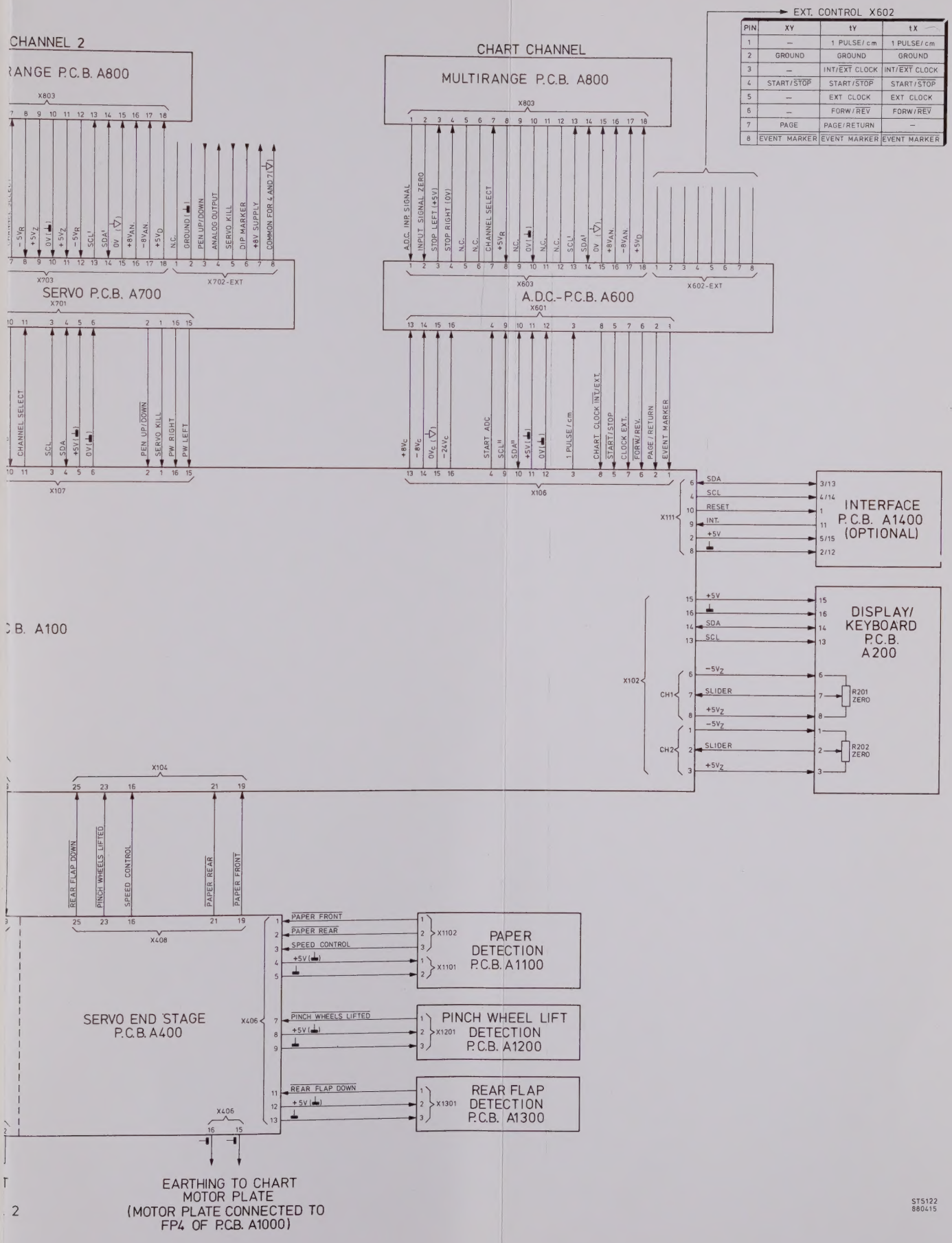


Figure 11.40 Interconnection diagram


EXT. CONTROL X602
PIN | XY | tY | tX
1 | – | 1 PULSE/cm | 1 PULSE/cm
2 | GROUND | GROUND | GROUND
3 | – | INT/EXT CLOCK | INT/EXT CLOCK
4 | START/STOP | START/STOP | START/STOP
5 | – | EXT CLOCK | EXT CLOCK
6 | – | FORW/REV | FORW/REV
7 | PAGE | PAGE/RETURN | –
8 | EVENT MARKER | EVENT MARKER | EVENT MARKER
CHANNEL 2
RANGE P.C.B. A800
CHART CHANNEL
MULTIRANGE P.C.B. A800
SERVO P.C.B. A700
A.D.C.-P.C.B. A600
INTERFACE P.C.B. A1400 (OPTIONAL)
DISPLAY/ KEYBOARD P.C.B. A200
R201 ZERO
R202 ZERO
SERVO END STAGE P.C.B. A400
PAPER DETECTION P.C.B. A1100
PINCH WHEEL LIFT DETECTION P.C.B. A1200
REAR FLAP DETECTION P.C.B. A1300
EARTHING TO CHART MOTOR PLATE (MOTOR PLATE CONNECTED TO FP4 OF P.C.B. A1000)

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